edexcel

GCSE (9-1) Design and Technology

This draft qualification has not yet been accredited by Ofqual. It is published to enable teachers to have early sight of our proposed approach to Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Design and Technology (1DT0). Further changes may be required and no assurance can be given at this time that the proposed qualification will be made available in its current form, or that it will be accredited in time for first teaching in September 2017 and first award in 2019.

Specification DRAFT

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Design and Technology (1DT0)

First teaching from September 2017

First certification from 2019

Pearson

Subject to
Ofqual accreditation
DRAFT

Contents

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1 Introduction

Why choose the Edexcel GCSE Design and Technology?

We've listened to feedback from all parts of the design and technology subject community, including teachers, subject associations, professional bodies and higher education. We've used this opportunity of curriculum change to redesign a qualification that is engaging and inspiring, and that reflects the demands of a truly modern and evolving society – a qualification that enables your students to apply themselves and develop the practical skills needed to succeed in their chosen pathway.

Building innovative design skills

Clear routes through the specification ––we've listened to your feedback and developed a new specification that provides clear routes for specialism in the material areas your students enjoy, and where you already have the resources and equipment in place.

Breadth and depth in our exam papers – our exam paper will assess the breadth of design and technology knowledge in the Core section, and assess the depth of knowledge in the chosen material category for the Specialist section to enable students to fully demonstrate their own particular strengths or specialism.

Creative design and making at the heart – the contextual challenges provided in our qualification, for example extending human capacity, will give students the freedom to take design risks and to innovate in a situation where it is safe to test and refine ideas.

Progression to AS and A Level – we've designed the GCSE and AS/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 of AS and A Level.

Support with the new content – to help you plan for first teaching with confidence, we'll be running a range of training events to support you with the new qualification and the new requirements. 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 GCSE 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 editable **course planners** and **schemes 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 teaching the properties and characteristics content for different material categories.
- guidance on contextual challenges within NEA.
- guidance 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 1/Level 2 GCSE (9–1) in Design and Technology 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 (*Paper code: 1DT0/1A, 1B, 1C, 1D, 1E, 1F)
Written examination: 1 hour and 45 minutes ***50% of the qualification*** ***100 marks***
Content overview • 1 – Core content and any **one** from the following material categories: • 2 – Metals • 3 – Papers and boards • 4 – Polymers • 5 – Systems • 6 – Textiles • 7 – Timbers
Assessment overview The paper consist of two sections. Section A is assessed on the core content and Section B is assessed on the material category students have chosen. 1DT0/1A – Metals, 1DT0/1B – Papers and boards, 1DT0/1C – Polymers, 1DT0/1D – Systems, 1DT0/1E – Textiles, 1DT0/1F – Timbers **Section A: Core** This section is 40 marks and contains a mixture of different question styles, including open-response, graphical, calculations and extended-open-response questions. There will be 10 marks of calculation questions in Section A. **Section B: Material categories** This section is 60 marks and contains a mixture of different question styles, including open-response, graphical, calculations and extended-open-response questions. There will be 5 marks of calculation questions in Section B.

*See *Appendix 6: Codes* for a description of this code and all other codes relevant to this qualification.

Component 2 (Paper code: 1DT0/02)
Non-examined assessment ***50% of the qualification*** ***100 marks***
Content overview There are four parts to the assessment: **1 – Investigate** This includes investigation of needs and research and a product specification **2 – Design** This includes producing different design ideas, review of initial ideas, development of design ideas into a chosen design, communication of design ideas and review of the chosen design **3 – Make** This includes manufacture and quality and accuracy **4 – Evaluate** This includes testing and evaluation.
Assessment overview • Students will undertake a project based on a contextual challenge released by us a year before certification. • This will be released on 1st June and will be available on our website. • The project will test students' skills in investigating, designing, making and evaluating a prototype of a product. • Task will be internally assessed and externally moderated. • The marks are awarded for each part are as follows: ○ **1** – **Investigate** (16 marks) ○ **2** – **Design** (42 marks) ○ **3** – **Make** (36 marks) ○ **4** – **Evaluate** (6 marks).

2 Subject content and assessment information

The GCSE in Design and Technology enables students to understand and apply iterative design processes through which they explore, create and evaluate a range of outcomes. The qualification enables students to use creativity and imagination to design and make prototypes (together with evidence of modelling to develop and prove product concept and function) that solve real and relevant problems, considering their own and others' needs, wants and values. It also gives students opportunities to apply knowledge from other disciplines, including mathematics, science, art and design, computing and the humanities.

Students will acquire subject knowledge in design and technology that builds on Key Stage 3, incorporating knowledge and understanding of different materials and manufacturing processes in order to design and make, with confidence, prototypes in response to issues, needs, problems and opportunities. Students learn how to take design risks, helping them to become resourceful, innovative and enterprising citizens. They should develop an awareness of practices from the creative, engineering and manufacturing industries. Through the critique of the outcomes of design and technology activity, both historic and present day, students should develop an understanding of its impact on daily life and the wider world and understand that high-quality design and technology is important to the creativity, culture, sustainability, wealth and wellbeing of the nation and the global community.

In the context of this document, the term 'prototype' refers to a functioning design outcome. A final prototype could be a highly-finished product, made as proof of concept before manufacture, or working scale models of a system where a full-size product would be impractical.

Qualification aims and objectives

The study of design and technology seeks to prepare students to participate confidently and successfully in an increasingly technological world. It helps students to be aware of, and learn from, wider influences on design and technology, including historical, social/cultural, environmental and economic factors.

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

- demonstrate their understanding that all design and technological activity takes place in contexts that influence the outcomes of design practice
- develop realistic design proposals as a result of the exploration of design opportunities and users' needs, wants and values
- use imagination, experimentation and combine ideas when designing
- develop the skills to critique and refine their own ideas while designing and making
- communicate their design ideas and decisions using different media and techniques, as appropriate for different audiences at key points in their designing
- develop decision-making skills, including the planning and organisation of time and resources when managing their own project work
- develop a broad knowledge of materials, components and technologies and practical skills to develop high-quality, imaginative and functional prototypes
- be ambitious and open to explore and take design risks in order to stretch the development of design proposals, avoiding clichéd or stereotypical responses
- consider the costs, commercial viability and marketing of products
- demonstrate safe working practices in design and technology
- use key design and technology terminology, including those related to: designing, innovation and communication; materials and technologies; making, manufacture and production; critiquing, values and ethics.

Mathematics

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

Scientific skills, knowledge and understanding

Science skills, knowledge and understanding underpin the theory and practice of design and technology. These skills will be embedded in the examination for this qualification. Please see *Appendix 2: Science skills, knowledge and understanding* for full details of these skills and examples of their application.

Component 1

Overview

The content is divided into two sections: core content and material categories. The core content provides students with a breadth of study and the material categories provides students with a depth of study. All students must study the Core content plus at least **one** material category.

All topics within the core content and material categories must be covered but can be delivered in any order or in an integrated approach.

1 – Core content

Key idea	What students need to learn
1.1 The impact of new and emerging technologies	1.1.1 Industry a unemployment b workforce skill set c demographic movement d science and technology parks
	1.1.2 Enterprise a privately-owned business b cloud funding c government funding for new business start-ups d not-for-profit organisations
	1.1.3 Sustainability a transportation costs b pollution c demand on natural resources d waste generated
	1.1.4 People a workforce b consumers c children d people with disabilities e wage levels f highly-skilled workforce g apprenticeships
	1.1.5 Culture a population movement within the EU b social segregation/clustering within ethnic minorities

Key idea	What students need to learn
	1.1.6 Society a changes in working hours and shift patterns b Internet of Things (IoT) c remote working d use of video conference meetings
	1.1.7 Environment a pollution b waste disposal c materials separation d transportation of goods around the world e packaging of goods
	1.1.8 Production techniques and systems a standardised design and components b Just-in-Time (JIT) c lean manufacturing d batch e continuous f one off g mass
1.2 How the critical evaluation of new and emerging technologies informs design decisions; considering contemporary and potential future scenarios from different perspectives, such as ethics and the environment	1.2.1 How to critically evaluate new and emerging technologies that inform design decisions a budget constraints b timescale c who the product is for d the materials used e manufacturing capabilities
	1.2.2 How critical evaluations can be used to inform design decisions, including the consideration of contemporary and potential future scenarios a natural disasters b medical advances c travel d global warming e communication

Key idea	What students need to learn
	1.2.3 Ethical perspectives when evaluating new and emerging technologies a where it was made b who was it made by c who will it benefit d fair-trade products
	1.2.4 Environmental perspectives when evaluating new and emerging technologies a use of materials b carbon footprint c energy usage and consumption during manufacture and transportation d life-cycle analysis (LCA)
1.3 How energy is generated and stored in order to choose and use appropriate sources to make products and power systems	1.3.1 Sources, generation and storage of energy a fossil fuels – oil, gas, coal b biofuels – biodiesel and biomass c tidal d wind e solar f hydroelectric
	1.3.2 Powering systems a batteries and cells b solar cells c mains electricity d wind power
	1.3.3 Factors to consider when choosing appropriate energy sources to make products and power systems a portability of the power source b environmental impact c power output d circuit/system connections e cost

Key idea	What students need to learn
1.4 Developments in modern and smart materials, composite materials and technical textiles	1.4.1 Modern and smart materials a Shape Memory Alloys (SMAs) b nanomaterials c reactive glass d piezoelectric materials e temperature responsive polymers f conductive inks
	1.4.2 Composites a concrete b plywood c fibre/carbon/glass d reinforced polymers e robotic materials
	1.4.3 Technical textiles a agro-textiles b construction textiles c geo-textiles d domestic textiles e environmentally friendly textiles f protective textiles g sports textiles
1.5 The functions of mechanical devices used to produce different sorts of movements, including the changing of magnitude and the direction of forces	1.5.1 Types of movement a linear b reciprocation c rotary d oscillation
	1.5.2 Classification of levers a class 1, 2 and 3 b calculations related to Mechanical Advantage (MA), Velocity Ratio (VR), load and effort and efficiency
	1.5.3 Linkages a bell crank b reverse motion linkages

Key idea	What students need to learn
	1.5.4 Cams a circular b pear c heart shaped
	1.5.5 Followers a roller b knife c flat followers
	1.5.6 Pulleys and belts a V-belt b Velocity Ratio (VR) c input and output speeds
	1.5.7 Cranks and sliders
	1.5.8 Gear types a simple and compound gear train b idler gear c revolutions per minute (RPM) calculations d bevel gears e rack and pinion

Key idea	What students need to learn
1.6 How electronic systems provide functionality to products and processes, including sensors and control devices to respond to a variety of inputs, and devices to produce a range of outputs	1.6.1 Sensors a light-dependent resistors (LDR) b thermistor
	1.6.2 Control devices and components a rocker switch (on/off) b resistors
	1.6.3 Outputs a buzzers b light-emitting diodes (LEDs)
1.7 The use of programmable components to embed functionality into products in order to enhance and customise their operation	1.7.1 How to make use of flowcharts
	1.7.2 How to switch outputs on/off in relation to inputs and decisions
	1.7.3 How to process and respond to analogue inputs
	1.7.4 How to use simple routines to control outputs with delays, loops and counts

Key idea	What students need to learn
1.8 The categorisation of the types, properties and structure of ferrous and non-ferrous metals	1.8.1 Ferrous metals a mild steel b stainless steel
	1.8.2 Non-ferrous metals a aluminium b copper c brass
	1.8.3 Properties a ductility b malleability
1.9 The categorisation of the types, properties and structure of the paper and boards	1.9.1 Paper a copier paper b biodegradable paper and board
	1.9.2 Board a folding boxboard b corrugated board c solid white board
	1.9.3 Properties a flexible b printability
1.10 The categorisation of the types, properties and structure of thermoforming and thermosetting polymers	1.10.1 Thermoforming polymers a acrylic b high impact polystyrene (HIPS) c polystyrene (PS) rigid (high density polystyrene) and expanded polystyrene d Styrofoam™ e biodegradable polymers – Biopol
	1.10.2 Thermosetting polymers a polyester resin b urea formaldehyde
	1.10.3 Properties a insulator of heat b insulator of electricity

Key idea	What students need to learn
1.11 The categorisation of the types, properties and structure of natural, synthetic, blended and mixed fibres, and woven, non-woven and knitted textiles	1.11.1 Natural a animal – wool b vegetable – cotton
	1.11.2 Synthetic a polyester b acrylic
	1.11.3 Woven a plain – calico b twill – denim
	1.11.4 Non-woven a felted wool fabric
	1.11.5 Knitted a warp and weft
	1.11.6 Properties a elasticity/resilience b durability
1.12 The categorisation of the types, properties and structure of natural and manufactured timbers	1.12.1 Natural timbers – hardwoods a oak b mahogany c beech d balsa e jelutong
	1.12.2 Natural timbers – softwoods a pine b cedar
	1.12.3 Manufactured timbers a plywood b medium density fibreboard (MDF)
	1.12.4 Properties a hardness b toughness

Key idea	What students need to learn
1.13 All design and technological practice takes place within contexts which inform outcomes	1.13.1 A wide range of materials, components and manufacturing processes for a range of contexts, including: a the properties of materials and or components b the advantages and disadvantages of materials and components and manufacturing processes c justification of the choice of materials and components and manufacturing processes
1.14 Investigate environmental, social and economic challenges when identifying opportunities and constraints that influence the processes of designing and making	1.14.1 Respect for different social, ethnic and economic groups who have different needs and values when identifying new design opportunities
	1.14.2 An appreciation for the environmental, social and economic issues relating to the design and manufacture of products, including, fair trade, carbon offsetting, product disassembly and disposal
	1.14.3 The main factors relating to 'Green Designs'
	1.14.4 The main factors relating to recycling and reusing materials or products
	1.14.5 Human capability
	1.14.6 Cost of materials
	1.14.7 Manufacturing capability
	1.14.8 Environmental impact – LCA
1.15 Investigate and analyse the work of past and present professionals and companies in order to inform design	1.15.1 Analysing a product to the following specification criteria: a form b function c user requirements d performance requirements e materials and components/systems f scale of production and cost g sustainability
	1.15.2 The work of past and present designers and companies a Alessi b Apple c Heatherwick Studio d Joe Casely-Hayford e Pixar f Raymond Loewy g Tesla h Zaha Hadid

Material categories

2 – Metals

Key idea	What students need to learn
2.1 Design contexts	2.1.1 When designing a product, students should be able to apply their knowledge and understanding of metals, components and manufacturing processes
2.2 The sources, origins, physical and working properties of ferrous and non-ferrous metals and their social and ecological footprint	2.2.1 Ferrous metals a mild steel (in topic 1) b stainless steel (in topic 1) c high carbon steel d tungsten steel
	2.2.2 Non-ferrous metals a aluminium (in topic 1) b copper (in topic 1) c brass (in topic 1) d tin e 7000 series aluminium f titanium
	2.2.3 Sources and origins – where ferrous and non-ferrous metals are resourced/manufactured and their geographical origin a USA, Russia, Sweden – iron ore b China – steel c USA, France, Australia – bauxite (aluminium) d USA, Chile, Zambia, Russia – copper e Indonesia, China – tin
	2.2.4 The physical characteristics of each ferrous and non-ferrous metal a conductivity b magnetism c density

Key idea	What students need to learn
	2.2.5 Working properties – the way in which the materials have to perform: a ductility (in topic 1) b malleability (in topic 1) c hardness d toughness e elasticity f tensile strength g compressive strength
	2.2.6 Social footprint a trend forecasting b impact of extraction and material production on communities and wildlife c ease and difficulty of recycling and disposal
	2.2.7 Ecological footprint a sustainability b extraction and erosion of the landscape c processing d transportation e wastage f pollution
2.3 The way in which the selection of ferrous and non-ferrous metals is influenced	2.3.1 Aesthetic factors a form b colour c texture
	2.3.2 Environmental factors a sustainability b pollution c energy consumption in the production of steel d effect of moisture and salt on untreated steel
	2.3.3 Availability factors a use of stock materials b use of specialist materials c impact of market price on world consumption and demand

Key idea	What students need to learn
	2.3.4 Cost factors a quality of material b manufacturing processes necessary c commodity price on the London Metal Exchange d cost of recycling in comparison to cost of producing new steel
	2.3.5 Social factors a use for different social groups b trends/fashion c popularity
	2.3.6 Cultural and ethical factors a avoiding offence b suitability for intended market c use of colour d use of language e the consumer society f the effects of mass production g built-in product obsolescence
2.4 The impact of forces and stresses on ferrous and non-ferrous metals and how they can be reinforced and stiffened	2.4.1 Forces and stresses a compression b tension c shear d electrical e magnetic
	2.4.2 Reinforcement/stiffening techniques a hardening b tempering c the effect of carbon content d work hardening e I, U, T and C beams

Key idea	What students need to learn
2.5 Stock forms, types and sizes in order to calculate and determine the quantity of ferrous and non-ferrous metals required	2.5.1 Stock forms/types a bar b sheet c plate d pipe/tube e castings f extrusions g wire h powder metallurgy
	2.5.2 Sizes a gauge b cross-sectional area c diameter d wall thickness of tubes
2.6 Alternative processes that can be used to manufacture ferrous and non-ferrous metal products to different scales of production	2.6.1 Processes a forging b casting c powder metallurgy d stamping e welding f extrusion g hardening
	2.6.2 Scales of production a one off b batch c mass production d continuous

Key idea	What students need to learn
	2.6.3 Techniques for quantity production – methods that are employed when making products in quantity a jigs b fixtures c templates d patterns e moulds f sub-assembly g CAM h quality control
2.7 Specialist techniques and processes that can be used to shape, fabricate, construct and assemble a high-quality ferrous and/or non-ferrous metal prototype	2.7.1 Shaping a filing b cutting/shearing c drilling d turning e milling f bending g abrading/grinding h casting
	2.7.2 Fabricating/constructing a welding b brazing c soldering d stamping e punching f riveting snap and pop g sheet metalwork
	2.7.3 Assembling a tapping/threading b fastening – use of nuts, bolts and washers c machine screws d use of adhesives – contact adhesive, epoxy resin

Key idea	What students need to learn
2.8 Appropriate surface treatments and finishes that can be applied to ferrous and non-ferrous metals for functional and aesthetic purposes	2.8.1 Surface finishes and treatments a paint b dip coating c electroplating d anodising e galvanising f powder coating g lacquering h polishing

3 – Papers and boards

Key idea	What students need to learn
3.1 Design contexts	3.1.1 When designing a product, students should be able to apply their knowledge and understanding of papers and boards, components and manufacturing processes
3.2 The sources, origins, physical and working properties of papers and boards and their social and ecological footprint	3.2.1 Paper a copier paper (in topic 1) b bonded c tracing paper d heat transfer printing paper (sublimation printing) e biodegradable paper and board (in topic 1)
	3.2.2 Board a folding boxboard (in topic 1) b corrugated board (in topic 1) c solid white board (in topic 1) d foil-lined board
	3.2.3 Packaging laminate (including Tetra Pak™) a paperboard b polyethylene c aluminium foil
	3.2.4 Sources and origins – where paper and boards are resourced/manufactured and their geographical origin a China, USA, Japan – pulp, paper and cardboard b Eastern Asia – rice paper
	3.2.5 The characteristics of each type of paper and board a density b transparency c texture
	3.2.6 Working properties: the way in which each material behaves or responds to external sources a weight b surface finish c printability d absorbancy

Key idea	What students need to learn
	3.2.7 Social footprint a trend forecasting b impact of material production on communities and wildlife c impact of logging and material production on communities and wildlife d recycling/disposal – ethical responsibility e reduction of packaging materials – reduction in litter/waste/energy use f brand identity – consumerism, changing the packaging of products over time
	3.2.8 Ecological footprint a sustainability b processing c transportation d wastage e pollution
3.3 The way in which the selection of papers and boards is influenced	3.3.1 Aesthetic factors a form b colour c texture d surface graphics (across all areas)
	3.3.2 Environmental factors a sustainability b pollution c genetic engineering
	3.3.2 Availability factors a stock materials b specialist materials
	3.3.3 Cost factors a quality of material b decorative techniques c manufacturing processes necessary
	3.3.4 Social factors a use for different social groups b trends/fashion c popularity

Key idea	What students need to learn
	3.3.5 Cultural and ethical factors a avoiding offence b suitability for intended purpose c the effects of mass production d the consumer society e use of colour
3.4 The impact of forces and stresses on papers and boards and how they can be reinforced and stiffened	3.4.1 Forces and stresses a bending b torsion c shear d compression
	3.4.2 Reinforcement/stiffening techniques a laminating b encapsulation c corrugation d additions of layers and ribs e sandwich construction f packaging laminates
3.5 Stock forms, types and sizes in order to calculate and determine the quantity of papers and boards required	3.5.1 Stock forms/types a weights b bond c laminates
	3.5.2 Sizes a common A sizes b foolscap c B series d letter e envelope

Key idea	What students need to learn
3.6 Alternative processes that can be used to manufacture paper and board products to different scales of production	3.6.1 Processes a printing b cutting c intermediate modelling of paper and card prototypes d frame modelling e test modelling
	3.6.2 Scales of production a one off b batch c mass production d continuous
	3.6.3 Techniques for quantity production a jigs for folding b stencils c templates d patterns e photocopying f CAM g quality control

Key idea	What students need to learn
3.7 Specialist techniques and processes that can be used to shape, fabricate, construct and assemble a high-quality paper and board prototype	3.7.1 Shaping a cutting b folding c notching d modelling e manipulation
	3.7.2 Fabricating/assembling/constructing a strengthening b addition of dissimilar materials – windows, inserts, stickers, temporary components c lamination d use of split pins e use of mapping pins f stapling g taping h paper engineering i use of adhesives j lettering k binding l marking-out tools
3.8 Appropriate surface treatments and finishes that can be applied to papers and boards for functional and aesthetic purposes	3.8.1 Surface finishes and treatments a varnishing b hot foil blocking c edge staining d embossing e UV varnishes f packaging laminates and films

4 – Polymers

Key idea	What students need to learn
4.1 Design contexts	4.1.1 When designing a product, students should be able to apply their knowledge and understanding of polymers, components and manufacturing processes
4.2 The sources, origins, physical and working properties of thermoforming and thermosetting polymers and their social and ecological footprint	4.2.1 Thermoforming polymers a acrylic (in topic 1) b high impact polystyrene (HIPS) (in topic 1) c polystyrene (PS) rigid (high density polystyrene) and expanded polystyrene (in topic 1) d Styrofoam™ (in topic 1) e biodegradable polymers – Biopol (in topic 1) f polyvinyl chloride g acrylonitrile-butadiene-styrene (ABS) h polyethylene terephthalate (PET) i urethane/polyurethane j fluoroelastomer
	4.2.2 Thermosetting polymers a polyester resin (in topic 1) b urea formaldehyde (in topic 1)
	4.2.3 Sources and origins – where thermoforming and thermosetting polymers are resourced/manufactured and their geographical origin a Russia, UAE, Saudi Arabia – crude oil
	4.2.4 The physical characteristics of each polymer a density b durability
	4.2.5 Working properties – the way in which each material behaves or responds to external sources a plasticity b hardness c toughness d tensile strength e compressive strength

Key idea	What students need to learn
	4.2.6 Social footprint a trend forecasting b impact of extraction and material production on the environment c impact of extraction and material production on wildlife d ease and difficulty of recycling and disposal
	4.2.7 Ecological footprint a sustainability b oil exploration and extraction c wildlife loss d processing e transportation f wastage g pollution
4.3 The way in which the selection of thermoforming and thermosetting polymers is influenced	4.3.1 Aesthetic factors a form b colour c texture
	4.3.2 Environmental factors a sustainability b pollution c biodegradable polymers – Biopol
	4.3.3 Availability factors a use of stock or specialist materials b use of specialist materials c effect of oil global oil supply and price
	4.3.4 Cost factors a quality of material b manufacturing processes necessary c treatments: fire proofing, additives
	4.3.5 Social factors a use for different social groups b trends/fashion c popularity

Key idea	What students need to learn
	4.3.6 Cultural and ethical factors a avoiding offence b suitability versus Cost decisions c use of colour and language d the consumer society e the effects of mass production f built-in product obsolescence
4.4 The impact of forces and stresses on thermoforming and thermosetting polymers and how they can be reinforced and stiffened	4.4.1 Forces and stresses a compression b tension c shear d flexibility
	4.4.2 Reinforcement/stiffening techniques a frame structures b triangulation c suitable fabrication/assembly/construction processes d use of additives
4.5 Stock forms, types and sizes in order to calculate and determine the quantity of thermoforming and thermosetting polymers required	4.5.1 Stock forms/types a bar b sheet c pipe/tube d mouldings e resin f granules/powder g film
	4.5.2 Sizes a thickness b cross-sectional area c sheet size d diameter

Key idea	What students need to learn
4.6 Alternative processes that can be used to manufacture thermoforming and thermosetting polymers products to different scales of production	4.6.1 Processes a blow moulding b press moulding c extrusion d injection moulding e polymer welding f line bending
	4.6.2 Scales of production a one off b batch c mass production d continuous
	4.6.3 Techniques for quantity production a jigs b templates c patterns d moulds e CAM f quality control
4.7 Specialist techniques and processes that can be used to shape, fabricate, construct and assemble a high-quality thermoforming and thermosetting polymers prototype	4.7.1 Shaping a laser cutting and engraving b cutting c filing d bending e abrading f vacuum forming
	4.7.2 Fabricating/constructing/assembling a tapping/threading b fastening – use of nuts, bolts and washers c use of adhesives – contact adhesive, epoxy resin, Tensol® cement, liquid cement (dichloromethane)

Key idea	What students need to learn
4.8 Appropriate surface treatments and finishes that can be applied to thermoforming and thermosetting polymers for functional and aesthetic purposes	4.8.1 Surface finishes and treatments a polishing b use of textured moulds or moulds with a fine surface finish c laser engraving d vinyl stickers e GRP pigments

5 – Systems

Key idea	What students need to learn
5.1 Design contexts	5.1.1 When designing a product, students should be able to apply their knowledge and understanding of systems, components and manufacturing processes
5.2 The sources, origins, physical and working properties of components and systems and their social and ecological footprint	5.2.1 Sensors a Light-dependent resistors (LDR) (in topic 1) b thermistor (in topic 1) c moisture sensor d piezoelectric sensor
	5.2.2 Control devices and components a rocker switch (on/off) (in topic 1) b resistors (in topic 1) c push to make switch (PTM) d micro switch e reed switch f variable resistors g transistor (bipolar) h microprocessor i relay
	5.2.3 Outputs a buzzers (in topic 1) b light-emitting diodes (LEDs) (in topic 1) c loudspeakers d motors
	5.2.4 Sources and origins – where components and systems are resourced/manufactured and their geographical origin: e Russia, Saudi Arabia, United States: polymers from crude oil – acrylic, high impact polystyrene (HIPS), acrylonitrile butadiene styrene (ABS) f China, Russia, USA – silicon g China, Australia, Russia – gold h Chile, China, Peru – copper i Australia, Chile, Argentina – lithium j China, Russia, Canada – aluminium k China, Australia, USA – Rare Earth Elements (REEs) l Philippines, Indonesia, Russia, Canada and Australia – nickel

Key idea	What students need to learn
	5.2.5 The physical characteristics of each component and system a tolerances, ratings and values – resistor colour codes b material selection for case construction – physical/working properties, sustainability, manufacturing processes
	5.2.6 Working properties – the way in which each material behaves or responds to external sources a conductors, insulators – thermal, electrical b polymers used for cases – durability, hardness, toughness, elasticity
	5.2.7 Social footprint a relying on scarce and/or hazardous elements used in components and systems – cobalt, tantalum, lithium b effects of using components and systems, including modern communications – mobile phones, computers, games consoles, social media networks
	5.2.8 Ecological footprint a effects of material extraction and processing of elements b effects of built-in obsolescence c effects of use d the effects of disposal of components and systems – toxicity of metals and polymers
5.3 The way in which the selection of components and systems is influenced	5.3.1 Aesthetic factors a the selection of materials and finishes for enclosures and cases – form, colour, texture
	5.3.2 Environmental factors a the principles of the Reduction of Hazardous Substances (RoHS) directive for selection b the principles of the Waste Electrical and Electronic Equipment (WEEE) directive for disposal
	5.3.3 Availability factors a use of scarce elements b use of stock or specialist components
	5.3.4 Cost factors a quality of component – tolerances b manufacturing processes necessary
	5.3.5 Social factors a use for different social groups b trends/fashion c popularity

Key idea	What students need to learn
	5.3.6 Cultural and ethical factors a avoiding offence b suitability versus cost decisions
5.4 The impact of forces and stresses on objects and how they can be reinforced and stiffened	5.4.1 Forces and stresses a tension b compression c torsion d shear
	5.4.2 Reinforcement/stiffening techniques a using composite materials b ribbing to strengthen case structures
5.5 Stock forms, types and sizes in order to calculate and determine the quantity of components required	5.5.1 Stock forms/types a tolerances, ratings and values – such as E12 series resistors b surface-mount technology (SMT) c through-hole components
	5.5.2 Sizes a unit of current (amp) b unit of resistance (ohm) c unit of potential difference (volt) d applications of Ohm's Law: V = I × R e resistors in series: Rtotal = R1 + R2 + R3 etc. f resistors in parallel: 1/Rtotal = 1/R1 + 1/R2 + 1/R3 etc.
5.6 Alternative processes that can be used to manufacture components and systems to different scales of production	5.6.1 Processes a photo etching b PCB population – PCB drilling and Soldering
	5.6.2 Scales of production a one-off prototyping (breadboard) b batch c mass production d continuous
	5.6.3 Techniques for quantity production a pick and place technology b surface-mount technology (SMT) c quality control

Key idea	What students need to learn
5.7 Specialist techniques and processes that can be used to shape, fabricate, construct and assemble a high-quality systems prototype	5.7.1 Shaping a vacuum forming b CNC laser cutting c 3D printing d drilling
	5.7.2 Fabricating/constructing/assembling a PCB mounting methods – through hole, surface mount b cable management – looms, sleeving, ties
5.8 Appropriate surface treatments and finishes that can be applied to components and systems for functional and aesthetic purposes	5.8.1 Surface finishes and treatments a metal plating to enhance the functionality and performance of electronic connections (functional/aesthetic) b insulating coatings and coverings for functionality/safety (functional) c resistor colour code bands to identify values and tolerance (functional) d finishes applied to cases – anodising, painting, screen printing (functional/aesthetic)

6 – Textiles

Key idea	What students need to learn
6.1 Design contexts	6.1.1 When designing a product, students should be able to apply their knowledge and understanding of textiles, components and manufacturing processes
6.2 The sources, origins, physical and working properties of natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textiles and their social and ecological footprint	6.2.1 Natural a animal i. wool (in topic 1) ii. silk b vegetable i. cotton (in topic 1) ii. linen
	6.2.2 Synthetic a polyester (in topic 1) b acrylic (in topic 1) c regenerated cellulosic – viscose, acetate, Tencel® d polyamide e elastane
	6.2.3 Woven a plain – calico (in topic 1) b twill – denim (in topic 1) c satin – jacquard d pile – velvet
	6.2.4 Non-woven a felted wool fabric (in topic 1) b bonded webs – Vilene®

Key idea	What students need to learn
	6.2.5 Sources and origins – where natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textiles are resourced/manufactured and their geographical origin a China, India, United states of America, Pakistan – cotton b China, India, Uzbekistan – silk c Russia, Canada, Ukraine, Europe (France and Belgium) – (flax) linen d Australia, New Zealand, China, USA, United Kingdom – wool e Alpine Forests – cellulose and wood pulp – cotton linters, pine, spruce, or hemlock trees – soft wood - acetate f European Forest – oak and birch – hard wood – Lyocell™ g Russia, UAE, Saudi Arabia – crude oil – polyester, nylon, acrylic
	6.2.6 The physical characteristics of each natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textile a elasticity/resilience b durability c electrical conductivity d heat conductivity e breathable (moisture vapour transport) f allergenic g texture h density
	6.2.7 Working properties – the way in which each material behaves or responds to external sources a durability b elasticity c tensile strength d absorbency

Key idea	What students need to learn
	6.2.8 Social footprint a trend forecasting b impact of material production on communities and wildlife c impact of farming and material production on communities and wildlife d recycling/disposal – ethical responsibility e reduction of chemical finishes – surface and aftercare treatments f reduction of packaging materials – reduction in litter/waste/energy use g brand identity – consumerism, changing the packaging of products over time
	6.2.9 Ecological footprint a sustainability b processing c transportation d wastage e pollution f deforestation g oil exploration and extraction h wildlife loss
6.3 The way in which the selection of natural, synthetic, blended and mixed-fibre textiles is influenced by	6.3.1 Aesthetic factors a form b colour c texture d lustre, sheen, shine
	6.3.2 Environmental factors a sustainability b genetic engineering c seasoning d upcycling
	6.3.3 Availability factors: a use of stock materials b use of specialist materials c environmental impact of hurricanes, storms and disease

Key idea	What students need to learn
	6.3.4 Cost factors a quality of material b manufacturing processes necessary c treatments: fire proofing, stain resist, water proofing d transportation – costs of moving materials around the world from country of origin
	6.3.5 Social factors a use for different social groups b trends/fashion c popularity
	6.3.6 Cultural and ethical factors a avoiding offence b suitability for intended market c use of colour and language d the consumer society e the effects of mass production f built-in product obsolescence
6.4 The impact of forces and stresses on natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textiles and how they can be reinforced and stiffened	6.4.1 Forces and stresses a compression b tension c shear d natural forces within the fibre as it grows – shape e flexibility
	6.4.2 Reinforcement/stiffening techniques a frame structures b suitable fabrication/assembly/construction processes c lamination d embedding composite materials e stay stitching

Key idea	What students need to learn
6.5 Typical stock forms, types and sizes used in order to calculate and determine the required quantity of natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textiles	6.5.1 Stock forms/types a rolls b blocks c denier d weights – single, double e laminates
	6.5.2 Sizes a standard width – 90 cm, 137 cm, 154 cm
6.6 Alternative processes that can be used to manufacture typical products of natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textiles to different scales of production	6.6.1 Processes that can be used to cut and shape materials a shears b stamp c laser cut d heating element – soldering iron e extrusion
	6.6.2 Scales of production a one off b batch c mass production d continuous
	6.6.3 Techniques for quantity production – methods that are employed when making products in quantity a templates b patterns c sub-assembly d CAM e quality control

Key idea	What students need to learn
6.7 Specialist techniques and processes that can be used on natural, synthetic, woven and non-woven, knitted, blended and mixed-fibre textiles to shape, fabricate, construct and assemble a high-quality prototype	6.7.1 Shaping a adding and reducing fullness – pleat, gather, dart, tucks, shirring, ease, godet, under stitching b moulding – steam, heat, adhesive c adding structure – interfacing, boning
	6.7.2 Fabricating/constructing a draping b seams – plain, felled, French, double stitching, topstitching c finishing raw edges – zig zagged, bound, rolled, turned under and sewn, blind hemming, invisible stitching d fusing – sealed seams, taping, bonding e component linkage f overlocking – 2, 3 or 4 thread – raw edges and joining g pressing, moulding
6.8 Appropriate surface treatments and finishes that can be applied to natural, synthetic, woven and non-woven, knitted, blended and mixed fibre textiles for functional and aesthetic purposes	6.8.1 Surface finishes and treatments a fabric painting (including silk) b batik c laminating d couching e embroidery f appliqué g printing h resist dyeing i patchwork j quilting k chemical – bleaching, easy-care, mercerising, carbonising, laminating, coating, fire proofing, stain resist, shrink resist water proofing, antistatic l physical – calendering, raising, heat-setting, desizing, singeing, emerising, milling, fulling, walking m biological – biostoning, biopolishing n smart – thermochromic, photochromic, solvation chromism, electrochromic, anti-bacterial, micro encapsulation

7 – Timbers

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

Key idea	What students need to learn
	7.2.5 Working properties – the way in which each material behaves or responds to external sources a durability b hardness c toughness d elasticity e tensile strength f compressive strength
	7.2.6 Social footprint a trend forecasting b impact of logging on communities c ease and difficulty of recycling and disposal
	7.2.7 Ecological footprint a sustainability b deforestation c habitat destruction and loss d processing e transportation f wastage g pollution
7.3 The way in which the selection of each natural and manufactured timber is influenced	7.3.1 Aesthetic factors a form b colour c texture
	7.3.2 Environmental factors a sustainability b genetic engineering c seasoning d upcycling
	7.3.3 Availability factors a use of stock materials b use of specialist materials c environmental impact of hurricanes, storms and disease

Key idea	What students need to learn
	7.3.4 Cost factors a quality of material b manufacturing processes necessary c treatments: fire proofing, tanilized
	7.3.5 Social factors a use for different social groups b trends/fashion c popularity
	7.3.6 Cultural and ethical factors a avoiding offence b suitability for intended market c use of colour and language d the consumer society e the effects of mass production f built-in product obsolescence
7.4 The impact of forces and stresses on each natural and manufactured timber and how they can be reinforced and stiffened	7.4.1 Forces and stresses a compression b tension c shear d natural forces within the timber as it grows e pre-stressed construction beams
	7.4.2 Reinforcement/stiffening techniques a frame structures b suitable fabrication/assembly/construction processes c lamination d use of braces and tie bars e embedding composite materials

Key idea	What students need to learn
7.5 Typical stock forms, types and sizes used in order to calculate and determine the required quantity of each natural and manufactured timber	7.5.1 Stock forms/types a regular sections b mouldings c dowels d sheets
	7.5.2 Sizes a PAR/PSE/imperial and metric b cross-sectional area c diameter d board sizes – 2440 mm × 1220 mm, 1220 mm × 610 mm
7.6 Alternative processes that can be used to manufacture typical products of each natural and manufactured timber to different scales of production	7.6.1 Processes that can be used to cut and shape materials a routing b sawing c use of a mortiser d use of a bag press
	7.6.2 Scales of production a one off b batch c mass production d continuous
	7.6.3 Techniques for quantity production – methods that are employed when making products in quantity a marking-out tools b jigs c fixtures d templates e patterns f sub-assembly g CAM h quality control

Key idea	What students need to learn
7.7 Specialist techniques and processes that can be used on each natural and manufactured timber to shape, fabricate, construct and assessable a high-quality prototype	7.7.1 Shaping a drilling b cutting c planing d chiselling e turning – face plate and between centres f abrading – glass paper g carving h use of rasps/surforms
	7.7.2 Fabricating/constructing a lamination b veneering c use of screws d nailing e use of adhesives – PVA, contact adhesive f jointing – butt, dowel, lap, housing, mitre, mortise and tenon, dovetail
	7.7.3 Assembling a knock-down fittings b hinges c ironmongery
7.8 Appropriate surface treatments and finishes that can be applied to each natural and manufactured timber for functional and aesthetic purposes	7.8.1 Surface finishes and treatments a painting b staining c varnishing d wax e oil f shellac g veneering h staining

Assessment information

- First assessment: May/June 2019.
- The assessment is 1 hour and 45 minutes.
- There are two sections to the paper: Section A – Core content and Section B – either Metals, Papers and Boards, Polymers, Systems, Textiles or Timbers.
- Section A – students must answer all questions. This section has four questions with a total of 40 marks.
- Section B – students must answer all questions. This section has four questions with a total of 60 marks.
- Each question is set in a context.
- The paper will include open-response, graphical, calculations and extended open-response questions.
- The paper will include questions that target mathematics.
- Calculators may be used in the examination.

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 1/Level 2 GCSE (9–1) in Design and Technology Sample Assessment Materials (SAMs)* document.

Component 2

Overview

Students will undertake a project as part of their non-examination assessment. The project will test students' skills in investigating, designing, making and evaluating a prototype of a product that will allow them to apply the skills they have acquired and developed throughout their study. Students are required to analyse a given contextual challenge from a range of three on an individual basis. Having selected a contextual challenge to work within students should develop a range of potential ideas and then realise one through practical making activities. The project must allow students to apply knowledge and understanding in a product development process to investigate, design, make and evaluate their prototype.

This project will require students to follow an iterative design process rather than a linear process requiring them to continually test, evaluate and refine ideas. The content and assessment criteria are set out in a linear format to show what is required at each stage of the total project, but following an iterative process students will do work on different stages at a variety of points thorough their project.

Content

1 – Investigate

Stage	What students need to do
1.1 Investigation of needs and research	1.1a Identify the needs of the end user 1.1b Outline a design problem from the context provided and identify a need for a product that could solve the problem 1.1c Investigate existing products to inform the product specification for the prototype 1.1d Carry out a range of research strategies to gather relevant information, to inform the design specification for the prototype, including: a market research b research into the context in which the prototype will be used c research into other possible materials d any sustainability issues that will be considered relevant to the intended prototype

Stage	What students need to do
1.2 Product specification	1.2a Production of a design brief, that addresses all needs previously identified 1.2b Production of a product specification that includes statements that are technical, measurable and justified, and include consideration of: a form b function c user requirements d performance requirements e material and component requirements f scale of production g cost h sustainability i performance requirements j user requirements 1.2c Identification of criteria, which will be used to evaluate the success of the prototype

2 – Design

Stage	What students need to do
2.1 Design ideas	2.1a Production of a range of design ideas that address the criteria in the design brief and product specification 2.1b Consideration of a range of issues when producing the design ideas, including: a budget b aesthetics c cultural issues d sustainability issues 2.1c Exploration of different design approaches, including: a materials b components c processes d techniques

Stage	What students need to do
2.2 Review of initial ideas	2.2a Analysis and evaluation of how each design idea meets the design brief and product specification 2.2b Determine which designs follow the design brief and product specification and should be taken forward for development 2.2c Modification of design ideas to fit the design brief and product specification
2.3 Development of design ideas into a chosen design	2.3a Consideration of user group needs and preferences, of design ideas, conducting further research where necessary 2.3b Consideration of the design as a whole, rather than focussing on component parts in isolation 2.3c Modelling/simulation used to test the features of the design ideas 2.3d Analysis and evaluation of the design ideas, to inform choice as to the chosen design to take forward 2.3e Modification of design ideas to produce the chosen design, which meets the design brief and product specification
2.4 Communication of design ideas	2.4a Use a range of communication techniques and media to present the design ideas, including: a freehand sketching (2D and/or 3D) b cut and paste techniques c digital photography/media d 3D models e Isometric and oblique projection f perspective drawing g orthographic and exploded views h assembly drawings i computer aided design (CAD) and other specialist computer drawing programs 2.4b Communicate the design ideas clearly and effectively using written techniques
2.5 Review of chosen design	2.5a Produce a chosen design solution for the product that meets the design brief and product specification 2.5b Consideration given to the materials, techniques and processes required to produce the chosen design solution 2.5c Incorporation of feedback from research into the chosen design

3 – Make

Stage	What students need to do
3.1 Manufacture	3.1a Production of a prototype that meets the requirements of the design brief and product specification, showing a wide range of making skills with precision and accuracy 3.1b Selection and application of: a material b range of tools c range of techniques d fixtures e components f finishes used in the manufacture of the prototype 3.1c Demonstration of safe working practical, for themselves and others
3.2 Quality and accuracy	3.2a Measuring the degree to which the prototype performs as intended 3.2b The prototype is accurately assembled and finished to a high-quality

4 – Evaluate

Stage	What students need to do
4.1 Testing and evaluation	4.1a Analyse the prototype against the product specification by conducting a variety of tests under realistic conditions, to ensure fitness for purpose 4.1b Analyse the results of the prototype testing 4.1c Evaluate whether the prototype meets the product specification 4.1d Evaluate the sustainability of the final prototype by carrying out a life-cycle assessment (LCA), in order to assess its impact on the environment

Assessment information

- Students will undertake a project based on a contextual challenge released by us a year before certification. This will be release on 1st June and will available on our website.
- This non-examined assessment will be carried out under controlled conditions.
- First assessment: June 2019.
- The NEA consists of 100 marks.
- The project consists of a portfolio and a prototype.
- 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.
- Centres must ensure that the NEA submitted is valid for the series in which they are entered.

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

Contextual challenge

The contextual challenge will provide a basis from which students can undertake an investigate, design, make and evaluate project. We will release this on 1st June, in the year before certification. We will provide three contextual challenges. The student can select one of these, with advice from the teacher.

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.

Project setting, taking and marking

Project setting

Pearson will communicate a contextual challenge to centres in June of the calendar year preceding the year in which the qualification is to be awarded. Students will be expected to undertake a small-scale project in response to this realistic contextual challenge, taking into account the needs and wants of the user.

Project research

Teaching and learning

Teachers should cover the content of this assessment, which covers:

- investigate
- design
- make
- evaluate.

Project controls relating to student independence and teacher guidance to students

Teachers

Can:

- provide broad parameters for students' 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 problems and students' initial approaches to solve the problems
- provide general levels of feedback to individuals or groups and allow students to revise and re-draft work

Must:

- confirm that the project has the potential to meet the assessment criteria and offer general guidance on any necessary amendments
- review each student's design brief. Within this review, teachers should ensure that the proposed design brief can suitably access the specification requirements and 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.

Must not:

- give students a choice of titles or tasks to choose from
- 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 only to take the initiative in making amendments, 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 students may then improve it
- return work to students after it has been submitted and marked
- give guidance on how to make improvements to the 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 independently, while the prototype is manufactured under immediate guidance or supervision in school/college. Where specialist processes or equipment are required beyond the school/college capabilities they may be utilised but must be documented in the appropriate section of the *Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Design and Technology 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 that goes beyond general guidance and do not take it into account when marking the work, this will be considered as malpractice. If malpractice is suspected, the awarding organisation 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*.

Project 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 HSE pro forma to assess likely hazards and risk. Students who might be lone working should be given 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. Students 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 that they will require in order to manufacture their final prototype with a high degree of accuracy and skill.

[1] [3] 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 approximately 20 to 30 sides of A3 paper for their design, make and evaluate project along with any models and their prototype. Students must not submit any portfolio larger than A3 size. Portfolios may also be produced as an electronic equivalent, using either Adobe or Power Point and submitted on a CD. 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 product 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/product is fit for purpose and in addition to being a working solution; addresses the needs/wants of the intended user and is successful in meeting the criteria of the specification. Images should show fully the details of the prototype/product, 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 or as hard copy within the portfolio. 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.

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.

Non-examined assessment criteria

Teachers must mark students' work using the following assessment criteria

1 – Investigate

Level	Mark	1.1 Investigation of needs and research (AO1 8 marks)
	0	No rewardable material
Level 1	1–3	• Evidence of limited investigation and identification of partially relevant design possibilities which are tentatively justified in relation to the contextual challenge. • Basic assessment of user needs and wants and the requirements of the prototype in response to the contextual challenge, with limited reference to form and function. • Superficial evidence of links between the design requirements and the research undertaken in relation to the contextual challenge.
Level 2	4–6	• Evidence of adequate investigation and identification of some relevant design possibilities which are justified in relation to the contextual challenge. • Adequate assessment of user needs and wants and the requirements of the prototype in response to the contextual challenge, with some reference to form and function. • Adequate evidence of links between the design requirements and the research undertaken in relation to the contextual challenge.
Level 3	7–8	• Evidence of developed investigation and identification of relevant design possibilities which are fully justified in relation to the contextual challenge. • Developed assessment of user needs and wants and the requirements of the prototype in response to the contextual challenge, with full reference to form and function. • Developed evidence of links between the design requirements and the research undertaken in relation to the contextual challenge.

Level	Mark	1.2 Specification (AO1 8 marks)
	0	No rewardable material
Level 1	1–3	• Basic design brief that demonstrates a simplistic response to the contextual challenge, addressing some of the investigated needs and wants of the user. • Simplistic range of specification points which are basic, and partially measurable, based on a superficial investigation of research in relation to the contextual challenge. • Simplistic justification of the performance requirements for the product in relation to the contextual challenge.
Level 2	4–6	• Competent design brief that demonstrates a coherent response to the contextual challenge, addressing some of the investigated needs and wants of the user. • Sufficient range of specification points which are realistic, and mostly measurable, based on a competent investigation of research in relation to the contextual challenge. • Sound justification of the performance requirements for the product in relation to the contextual challenge.
Level 3	7–8	• Considered design brief that demonstrates a realistic response to the contextual challenge, addressing most of the investigated needs and wants of the user. • Effective range of specification points which are realistic, technical and measurable, based on a considered investigation of research in relation to the contextual challenge. • Reasoned justification of the performance requirements for the product in relation to the contextual challenge.

2 – Design

Level	Mark	2.1 Design ideas (AO2 8 marks)
	0	No rewardable material
Level 1	1–3	• Basic selection and use of design strategies to inform decisions to generate a limited range of simplistic design ideas in response to the contextual challenge. • General consideration for the user needs and specification parameters. • Ideas demonstrate a simplistic understanding of some materials and processes.
Level 2	4–6	• Competent selection and use of design strategies to inform decisions to generate a wide range of design ideas in response to the contextual challenge. • Competent consideration for the user needs and specification parameters. • Ideas demonstrate a competent understanding of relevant materials, processes and techniques.
Level 3	7–8	• Considered selection and use of design strategies to inform decisions to generate a wide range of design ideas in response to the contextual challenge. • Balanced consideration for the user needs and specification parameters. • Ideas demonstrate a considered understanding of relevant materials, processes and techniques.

Level	Mark	2.2 Review of initial ideas (AO3 8 marks)
	0	No rewardable material
Level 1	1–3	• Superficial analysis of design ideas in response to the contextual challenge, which only considers basic factors and makes limited connections between elements of the design. • Imbalanced evaluation of design ideas leading to a limited refinement and development of designs, demonstrating a limited understanding of design considerations.
Level 2	4–6	• Clear analysis of design ideas, leading to competent refinement and development of designs, which considers sufficient factors and makes competent connections between elements of the design. • Sound evaluation of design ideas leading to effective refinement and development of designs, demonstrating a competent understanding of design considerations.
Level 3	7–8	• Developed analysis of design ideas leading to effective refinement and development of designs, which considers comprehensive factors and makes developed connections between elements of the design. • Balanced evaluation of design ideas leading to effective refinement and development of designs, demonstrating a considered understanding of design considerations.

Level	Mark	2.3 Development of design ideas into a chosen design (AO1 4 marks AO2 8 marks)
	0	No rewardable material
Level 1	1–3	• Emerging use of research to inform ongoing developmental changes. • Emerging refinements of design ideas and a design solution that meets part of the design specification, informed by the basic application of technical knowledge of materials and an emerging application of modelling/simulation techniques. • Chosen design idea shows inconsistent technical details of some materials and components that could be partly interpreted by a third party.
Level 2	4–6	• Adequate use of research to inform ongoing developmental changes. • Competent refinements of design ideas and a design solution that meets most of the requirements of the design specification, informed by the sound application of technical knowledge of materials and/or processes and the appropriate application of modelling/simulation techniques. • Chosen design idea shows coherent application of calculations to determine some material quantities and technical details of most materials and components that could be reliably interpreted by a third party.
Level 3	7–9	• Assured use of research to inform ongoing developmental changes. • Reasoned refinements of design ideas and a design solution that effectively meets the requirements of the design specification, informed by the proficient application of technical knowledge of materials and processes and the assured application of modelling/simulation techniques. • Chosen design idea shows logical application of calculations to determine most material quantities and technical details of materials, processes and components that could be effectively interpreted by a third party.
Level 4	10–12	• Comprehensive use of research to inform ongoing developmental changes. • Perceptive refinements of design ideas and a design solution that fully meets the requirements of the design specification, informed by the comprehensive application of technical knowledge of materials and processes and the fluent application of modelling/simulation techniques. • Chosen design idea shows concise application of calculations to determine all material quantities and technical details of materials, processes and components that could be fully interpreted by a third party.

Level	Mark	2.4 Communication of design ideas (AO2 8 marks)
	0	No rewardable material
Level 1	1–3	• Basic selection and inconsistent use of graphical techniques to communicate design ideas. • Basic selection and inconsistent use of computer aided design (CAD) techniques to communicate design ideas. • Basic selection and inconsistent use of written techniques to communicate design ideas.
Level 2	4–6	• Relevant selection and appropriate use of graphical techniques to communicate design ideas. • Relevant selection and appropriate use of computer aided design (CAD) techniques to communicate design ideas. • Relevant selection and appropriate use of written techniques to communicate design ideas.
Level 3	7–8	• Considered selection and effective use of techniques to communicate design ideas. • Considered selection and effective use of computer aided design (CAD) techniques to communicate design ideas. • Considered selection and effective use of written techniques to communicate design ideas.

Level	Mark	2.5 Review of chosen design (AO3 6 marks)
	0	No rewardable material
Level 1	1–2	• Basic analysis of the refinements made to the chosen design in response to the contextual challenge, which considers only basic factors and makes limited connections between elements of the design. • Imbalanced evaluation of the refinements made to the chosen design, with occasional reference to feedback made by others, and the consideration of the materials and components.
Level 2	3–4	• Competent analysis of the refinements made to the chosen design in response to the contextual challenge, which considers sufficient factors and makes competent connections between elements of the design. • Sound evaluation of the refinements made to the chosen design, with coherent reference to feedback made by others, and the consideration of the materials, components and manufacturing techniques.
Level 3	5–6	• Secure analysis of the refinements made to the chosen design in response to the contextual challenge, which considers comprehensive factors and makes developed connections between elements of the design. • Balanced evaluation of the refinements made to the chosen design, supported by developed reference to feedback made by others and the consideration of the materials, components and manufacturing techniques.

3 – Make

Level	Mark	3.1a Manufacture – selection of materials (AO2 8 marks)
	0	No rewardable material
Level 1	1–3	• Basic selection of materials that are appropriate for the chosen prototype. • Shows sufficient understanding of the material properties of the materials used in the prototype.
Level 2	4–6	• Considered selection of materials that are appropriate for the chosen prototype. • Shows a reasoned understanding of material properties of the materials used in the prototype.
Level 3	7–8	• Comprehensive selection of materials that are fully appropriate for the chosen prototype. • Showing a perceptive understanding of material properties of the materials used in the prototype.

Level	Mark	3.1b Manufacture – skills and processes (AO2 16 marks)
	0	No rewardable material
Level 1	1–4	• Produce a prototype that demonstrates basic making skills. • Basic selection of materials, fixtures, components and fittings which are partially appropriate for the chosen prototype. • Inconsistent use of tools, equipment and techniques for the manufacture of the prototype. • Demonstrate a basic degree of safe working practice for self and others.
Level 2	5–8	• Produce a prototype that demonstrates competent making skills. • Adequate selection of materials, fixtures, components and fittings, which are mostly appropriate for the chosen prototype. • Competent use of tools, equipment and techniques for the manufacture of the prototype. • Demonstrate an adequate degree of safe working practice for self and others.
Level 3	9–12	• Produce a prototype that demonstrates consistent making skills. • Considered selection of materials, fixtures, components and fittings, which are appropriate for the chosen prototype. • Skilful use of tools, equipment and techniques for the manufacture of the prototype. • Demonstrate a high degree of safe working practice for self and others.

Level	Mark	3.1b Manufacture – skills and processes (AO2 16 marks) (*continued*)
Level 4	13–16	• Produce a prototype that demonstrates accomplished making skills. • Comprehensive selection of fixtures, components and fittings, which are entirely appropriate for the chosen prototype. • Assured use of tools, equipment and techniques for the manufacture of the prototype. • Demonstrate a sustained high degree of safe working practice for self and others.

Level	Mark	3.2 Quality and accuracy (AO2 12 marks)
	0	No rewardable material
Level 1	1–3	• Produce a simplistic prototype that partially meets the end user needs. • Produce a prototype that meets the basic aspects of the design specification. • Shows a basic understanding of the need for accuracy.
Level 2	4–6	• Produce a partly-functioning prototype that adequately meets the end user needs. • Produce a prototype that meets some aspects of the design specification. • Shows an adequate understanding of the need for accuracy.
Level 3	7–9	• Produce a mostly functioning prototype that mostly meets the end user needs. • Produce a prototype that mostly meets the design specification. • Shows a secure understanding of the need for accuracy.
Level 4	10–12	• Produce an effective and functioning prototype that fully meets the end user needs. • Produce a prototype that comprehensively meets the design specification. • Shows a perceptive understanding of the need for accuracy.

4 – Evaluate

Level	Mark	4.1 Testing and evolution (AO3 6 marks)
	0	No rewardable material
Level 1	1–2	• Basic analysis of the prototype developed in response to the contextual challenge, taking into account the end user and product specification, showing a considered approach to testing against measurable criteria. • Unbalanced evaluation of the prototype, taking into account the intended purpose of the prototype, drawing emerging conclusions from testing against measureable criteria.
Level 2	3–4	• Competent analysis of the prototype developed in response to the contextual challenge, taking into account the end user and product specification, showing an adequate approach to testing against measurable criteria. • Coherent evaluation of the prototype, taking into account the intended purpose of the prototype, drawing clear conclusions from testing against measureable criteria.
Level 3	5–6	• Comprehensive analysis of the prototype developed in response to the contextual challenge, taking into account the end user and product specification, showing a considered approach to testing against measurable criteria. • Thorough and balanced evaluation of the prototype, taking into account the intended purpose of the prototype, drawing perceptive conclusions from testing against measureable criteria.

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. As students are producing prototypes, 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 GCSE
AO1	Identify, investigate and outline design possibilities to address needs and wants	10
AO2	Design and make prototypes that are fit for purpose	30
AO3	Analyse and evaluate: • design decisions and outcomes, including for prototypes made by themselves and others • wider issues in design and technology	20
AO4	Demonstrate and apply knowledge and understanding of: • technical principles • designing and making principles	40
	Total	**100%**

Breakdown of Assessment Objectives

Component	Assessment Objectives				Total for all Assessment Objectives
	AO1 %	AO2 %	AO3 %	AO4 %	
Component 1	0	0	10	40	50%
Component 2	10	30	10	0	50%
Total for GCSE	**10%**	**30%**	**20%**	**40%**	**100%**

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 code and performance tables

Centres should be aware that students who enter for more than one GCSE, or other Level 2 qualifications with the same discount code, will have only the grade for their 'first entry' counted for the purpose of the school and college performance tables (please see *Appendix 6: Codes*). For further information about what constitutes 'first entry' and full details of how this policy is applied, please refer to the DfE website: www.gov.uk/government/organisations/department-for-education

Students should be advised that if they take two GCSEs with the same discount code, schools and colleges they wish to progress to are likely to take the view that this achievement is equivalent to only one GCSE. The same view may be taken if students take two GCSEs or other Level 2 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, including:

- 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, or affects timeframes or 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 candidate'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 completed form can be emailed to pqsmalpractice@pearson.com or posted to Investigations Team, Pearson, 190 High Holborn, London, WC1V 7BH. 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 can be emailed to pqsmalpractice@pearson.com or posted to Investigations Team, Pearson,190 High Holborn, London, WC1V 7BH. 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 GCSE qualification will be graded and certificated on a nine-grade scale from 9 to 1 using the total subject mark where 9 is the highest grade. 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.

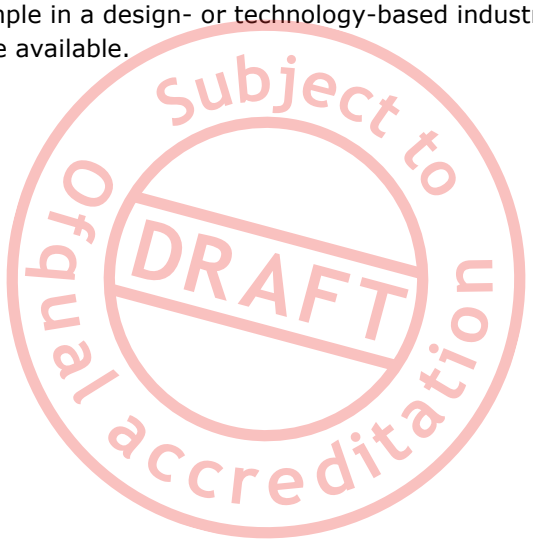
Prior learning and other requirements

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

Progression

Students can progress from this qualification to:

- GCEs, for example GCE A Level or AS in Design and Technology
- Level 3 vocational qualifications, for example the BTEC Level 3 qualifications in Engineering
- employment, for example in a design- or technology-based industry where an Apprenticeship may be available.



Appendices

Appendix 1: Mathematical skills

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

The mathematical skills listed will be assessed in the examination only. The minimum level of mathematics in the examinations will be equivalent to Key Stage 3 mathematics.

Mathematical skills that will be assessed		**Examples of design and technology applications**
1	**Arithmetic and numerical computation**	
a	Recognise and use expressions in decimal and standard form	Calculation of quantities of materials, costs and sizes
b	Use ratios, fractions and percentages	Scaling drawings, analysing responses to user questionnaires
c	Calculate surface area and volume	Determining quantities of materials
2	**Handling data**	
a	Presentation of data, diagrams, bar charts and histograms	Construct and interpret frequency tables; present information on design decisions
3	**Graphs**	
a	Plot, draw and interpret appropriate graphs	Analysis and presentation of performance data and client survey responses
b	Translate information between graphical and numeric form	Extracting information from technical specifications
4	**Geometry and trigonometry**	
a	Use angular measures in degrees	Measurement and marking out, creating tessellated patterns
b	Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects	Graphic presentation of design ideas and communicating intentions to others
c	Calculate areas of triangles and rectangles, surface areas and volumes of cubes	Determining the quantity of materials required

These mathematical skills will be assessed in the examination in both Section A and Section B. A minimum of 15 marks of the examination will be for mathematical skills, with questions involving mathematics always in an applied context.

These skills will be sampled in the examination but will all be covered over the lifetime of the qualification. Examples of mathematical questions are Questions 2(b) and 4(b) in the *Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Design and Technology Sample Assessment Materials (SAMs).*

Appendix 2: Scientific skills, knowledge and understanding

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

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

Scientific knowledge and skills that will be assessed		Examples of design and technology applications
1	**Use scientific vocabulary, terminology and definitions**	
a	quantities, units and symbols	Appropriate use of scientific terms when developing a design brief and specifications
b	SI units (e.g. kg, g, mg; km, m, mm; kJ, J), prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano)	Calculation of quantities, measurement of materials and selection of components
c	metals and non-metals and the differences between them, on the basis of their characteristic physical and chemical properties	Classification of the types and properties of a range of materials
2	**Life cycle assessment and recycling**	
a	the basic principles in carrying out a life-cycle assessment of a material or product	Selection of materials and components based on ethical factors, taking into consideration the ecological and social footprint of materials
3	**Using materials**	
a	the conditions which cause corrosion and the process of corrosion and oxidisation	Understanding of properties of materials and how they need to be protected from corrosion through surface treatments and finishes. Appreciate how oxidisation can be used when dyeing materials.
b	the composition of some important alloys in relation to their properties and uses	Selecting appropriate materials
c	the physical properties of (materials)], how the properties of materials are selected related to their uses	Knowledge of properties of materials to be applied when designing and making
d	the main energy sources available for use on Earth (including fossil fuels, nuclear fuel, bio-fuel, wind, hydro-electricity, the tides and the Sun), the ways in which they are used and the distinction between renewable and non-renewable sources	Understanding of how to choose appropriate energy sources

Scientific knowledge and skills that will be assessed		Examples of design and technology applications
e	the action of forces and how levers and gears transmit and transform the effects of forces	Knowledge of the function of mechanical devices to produce different sorts of movement, changing the magnitude and direction of forces

These skills will be sampled in the examination but all will be covered over the lifetime of the qualification. Examples of questions that include scientific knowledge and skills are Questions 1(a)(i) and 4(d) in the *Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Design and Technology Sample Assessment Materials (SAMs).*

Appendix 3: Taxonomy

The following table lists the command words used in the external assessments.

Command word	Definition
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.
Discuss	Identify the issue/situation/problem/concept/argument within the question. Explore aspects of the issue/element/situation/problem/concept/argument. Investigate the issue/situation etc. by reasoning or argument. Does not require a conclusion.
Evaluate	Measure the value or success of something and ultimately provide a substantiated judgement/conclusion. Review information and then bring it together to form a conclusion, drawing on evidence such as strengths, weaknesses, alternatives and relevant data.
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.
Give/State/Name	All of these command words are really synonyms. They generally all require recall of one or more pieces of information.
Identify	Usually requires some key information to be selected from a given stimulus/resource.
Use annotated sketches to show	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/depth of answer required will be indicated by the mark allocation.

Please refer to the *Pearson Edexcel Level 1/Level 2 GCSE (9–1) in Design and Technology Sample Assessment Materials (SAMs)* for the application of these command words.

Appendix 4: 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:

- 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 *GCSE (9 to 1) Qualification Level Conditions and Requirements* and *GCSECE Subject Level Conditions and Requirements for Design and Technology*, published in April 2014.

[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 5*.

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:

- benchmarking assessments against UK 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 5: 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.

[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 6: 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)	TBC
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: XXX/XXXX/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.	GCSE – 1DT0
Component codes	These codes are provided for reference purposes. Students do not need to be entered for individual components.	Component 1: 1DT0/1A – Metals 1DT0/1B – Papers and boards 1DT0/1C – Polymers 1DT0/1D – Systems 1DT0/1E – Textiles 1DT0/1F – Timbers Component 2: 1DT0/02

Edexcel, BTEC and LCCI qualifications

Edexcel, BTEC and LCCI qualifications are awarded by Pearson, the UK's largest awarding body offering academic and vocational qualifications that are globally recognised and benchmarked. For further information, please visit our qualification websites at www.edexcel.com, www.btec.co.uk or www.lcci.org.uk. Alternatively, you can get in touch with us using the details on our contact us page at qualifications.pearson.com/contactus

About Pearson

Pearson is the world's leading learning company, with 40,000 employees in more than 70 countries working to help people of all ages to make measurable progress in their lives through learning. We put the learner at the centre of everything we do, because wherever learning flourishes, so do people. Find out more about how we can help you and your learners at qualifications.pearson.com

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