GCE AS/A LEVEL

WJEC GCE AS/A Level in

DESIGN AND TECHNOLOGY

APPROVED BY QUALIFICATIONS WALES

SPECIFICATION

Teaching from 2017

For award from 2018 (AS)
For award from 2019 (A level)

This Qualifications Wales regulated qualification is not available to centres in England.

WJEC GCE AS and A LEVEL In DESIGN AND TECHNOLOGY

For teaching from 2017
For AS award from 2018
For A level award from 2019

This specification meets the Approval Criteria for GCE AS and A Level Design and Technology and the GCE AS and A Level Qualification Approval Criteria which set out the requirements for all new or revised GCE specifications developed to be taught in Wales from September 2017.

GCE AS AND A LEVEL DESIGN AND TECHNOLOGY

(Wales) SUMMARY OF ASSESSMENT

This specification is divided into a total of 4 assessment units, 2 AS units and 2 A2 units. Weightings noted below are expressed in terms of the full A level qualification.

AS (2 units)

AS Unit 1: Written paper 1
Written examination: 2 hours
20% of qualification — **80** marks

Learners take an examination in one of the following endorsed areas:

- engineering design
- fashion and textiles
- product design.

The examination includes a mix of structured and extended writing questions assessing learners' knowledge and understanding of:

- technical principles
- designing and making principles

along with their ability to:

- analyse and evaluate design decisions and wider issues in design and technology.

AS Unit 2: Design and make task
Non-exam assessment: approximately 40 hours
20% of qualification — **80** marks

A design and make task, based on a brief developed by the candidate, assessing the candidate's ability to:

- identify, investigate and outline design possibilities
- design and make prototypes
- analyse and evaluate design decisions and wider issues in design and technology.

The design and make task will be based within the same endorsed area as the written examination.

A Level (plus a further 2 units)

A2 Unit 3: Written paper 2
Written examination: 2 hours 30 minutes
30% of qualification **100** marks

Learners take a single examination in one of the following endorsed areas:

- engineering design
- fashion and textiles
- product design.

The examination includes a mix of structured and extended writing questions assessing learners' knowledge and understanding of:

- technical principles
- designing and making principles

along with their ability to:

- analyse and evaluate design decisions and wider issues in design and technology.

A2 Unit 4: Design and make project
Non-exam assessment: approximately 60 hours
30% of qualification **100** marks

A sustained design and make project, based on a brief developed by the candidate, assessing the candidate's ability to:

- identify, investigate and outline design possibilities
- design and make prototypes
- analyse and evaluate design decisions and wider issues in design and technology.

The design and make project will be based within the same endorsed area as the written examination.

This is a unitised specification which allows for an element of staged assessment. Assessment opportunities will be available in the summer assessment period each year, until the end of the life of the specification.

Unit 1 and Unit 2 will be available in 2018 (and each year thereafter) and the AS qualification will be awarded for the first time in summer 2018.

Unit 3 and Unit 4 will be available in 2019 (and each year thereafter) and the A level qualification will be awarded for the first time in summer 2019.

Qualification Approval Numbers
GCE AS: C00/1179/5
GCE A level: C00/1166/8

GCE AS and A LEVEL DESIGN AND TECHNOLOGY

1 INTRODUCTION

1.1 Aims and objectives

The WJEC GCE in Design and Technology offers a unique opportunity in the curriculum for learners to identify and solve real problems by designing and making products or systems.

Design and technology is an inspiring, rigorous and practical subject. This specification encourages learners to use creativity and imagination when applying iterative design processes to develop and modify designs, and to design and make prototypes that solve real world problems, considering their own and others' needs, wants, aspirations and values.

The specification enables learners to identify market needs and opportunities for new products, initiate and develop design solutions, and make and test prototypes. Learners should acquire subject knowledge in design and technology, including how a product can be developed through the stages of prototyping, realisation and commercial manufacture. Learners should consider small and large commercial / manufacturing contexts and gain an insight into design and technology activity in the creative industries.

Learners should take every opportunity to integrate and apply their understanding and knowledge from other subject areas studied during key stage 4, with a particular focus on science and mathematics, and those subjects they are studying alongside GCE design and technology.

As learners need to demonstrate expertise in specialist areas, three subject endorsements are available (*engineering design, fashion and textiles,* and *product design*), linked to design disciplines that reflect possible higher education routes and industry.

This specification enables learners to work creatively when designing and making and apply technical and practical expertise, in order to:

- be open to taking design risks, showing innovation and enterprise whilst considering their role as responsible designers and citizens, develop intellectual curiosity about the design and manufacture of products and systems, and their impact on daily life and the wider world
- work collaboratively to develop and refine their ideas, responding to feedback from users, peers and expert practitioners
- gain an insight into the creative, engineering and/or manufacturing industries
- develop the capacity to think creatively, innovatively and critically through focused research and the exploration of design opportunities arising from the needs, wants and values of users and clients

- develop knowledge and experience of real world contexts for design and technological activity
- develop an in-depth knowledge and understanding of materials, components and processes associated with the creation of products that can be tested and evaluated in use
- be able to make informed design decisions through an in-depth understanding of the management and development of taking a design through to a prototype/product
- be able to create and analyse a design concept and use a range of skills and knowledge from other subject areas, including mathematics and science, to inform decisions in design and the application or development of technology
- be able to work safely and skilfully to produce high-quality prototypes
- have a critical understanding of the wider influences on design and technology, including cultural, economic, environmental, historical and social factors
- develop the ability to draw on and apply a range of skills and knowledge from other subject areas, including the use of mathematics and science for analysis and informing decisions in design.

This specification also gives learners an opportunity to produce extended written responses and demonstrate the quality of their written communication, including appropriate use of punctuation and grammar.

1.2 Prior learning and progression

Any requirements set for entry to a course following this specification are at the discretion of centres. It is reasonable to assume that many learners will have achieved qualifications equivalent to Level 2 at key stage 4. Skills in numeracy / mathematics, science, literacy / English and ICT will provide a good basis for progression to this Level 3 qualification.

This specification builds on the knowledge, understanding and skills established at GCSE.

This specification provides a suitable foundation for the study of design and technology or a related area through a range of higher education courses, progression to the next level of vocational qualifications or employment. In addition, the specification provides a coherent, satisfying and worthwhile course of study for learners who do not progress to further study in this subject.

This specification is not age specific and, as such, provides opportunities for learners to extend their life-long learning.

1.3 Equality and fair access

This specification may be followed by any learner, irrespective of gender, ethnic, religious or cultural background. It has been designed to avoid, where possible, features that could, without justification, make it more difficult for a learner to achieve because they have a particular protected characteristic.

The protected characteristics under the Equality Act 2010 are age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

The specification has been discussed with groups who represent the interests of a diverse range of learners, and the specification will be kept under review.

Reasonable adjustments are made for certain learners in order to enable them to access the assessments (e.g. learners are allowed access to a Sign Language Interpreter, using British Sign Language). Information on reasonable adjustments is found in the following document from the Joint Council for Qualifications (JCQ): *Access Arrangements and Reasonable Adjustments: General and Vocational Qualifications.*

This document is available on the JCQ website (www.jcq.org.uk). As a consequence of provision for reasonable adjustments, very few learners will have a complete barrier to any part of the assessment.

1.4 Welsh Baccalaureate

In following this specification, learners should be given opportunities, where appropriate, to develop the skills that are being assessed through the Skills Challenge Certificate within the Welsh Baccalaureate:

- Literacy
- Numeracy
- Digital Literacy
- Critical Thinking and Problem Solving
- Planning and Organisation
- Creativity and Innovation
- Personal Effectiveness.

1.5 Welsh perspective

In following this specification, learners should be given opportunities, where appropriate, to consider a Welsh perspective if the opportunity arises naturally from the subject matter and if its inclusion would enrich learners' understanding of the world around them as citizens of Wales as well as the UK, Europe and the world.

2 SUBJECT CONTENT

Learners follow one endorsed route through this specification: either *engineering design; fashion and textiles* or *product design*.

Learners study the following areas of content, selecting one endorsed area from the three available:

- 2.1 Core technical principles – AS and A level
- 2.2 Core technical principles – A level only
- 2.3 In-depth technical principles
  - 2.3.1 Engineering design – AS and A level
  - 2.3.2 Engineering design – A level only
  - 2.3.3 Fashion and textiles – AS and A level
  - 2.3.4 Fashion and textiles – A level only
  - 2.3.5 Product design – AS and A level
  - 2.3.6 Product design – A level only
- 2.4 Core design and making principles – AS and A level
- 2.5 Core design and making principles – A level only

The written assessments focus on the core technical principles, and in-depth technical principles for one endorsed area, at either AS (Unit 1) or A level (Unit 3).

Unit 1 assesses all of the content presented in Section 2.1 (along with one sub-section selected from 2.3.1, 2.3.3 and 2.3.5) at AS standard.

Unit 3 assesses all of the content presented in Section 2.1 and Section 2.2 (along with two sub-sections selected from 2.3.1 to 2.3.6 and related to a single endorsed area) at A level standard.

Whilst the NEA units focus on assessment of the content presented in sections 2.4 and 2.5 (Unit 4) and section 2.4 only (Unit 2), knowledge and understanding of designing and making principles will be assessed in the written assessments.

The specification content and assessment requirements are designed to ensure learners develop an appropriate breadth and depth of knowledge and understanding at an advanced level in design and technology.

Learners are required to study all of the content specified, to ensure they have a broad knowledge and understanding of design and technology and that they are able to make effective choices in relation to which materials, components and systems to utilise within design and make activities.

2.1 Core technical principles (AS and A level)

The following technical principles apply to all endorsed areas

Learners are required to develop knowledge and understanding of:

Content	Amplification

(a) How manufactured products typically involve multiple materials, processes and techniques and that designers need to be able to discriminate between them and select them appropriately for use, experimenting in order to improve, refine and realise a design	• The complexity and inter-relationship between parts/components/materials in a manufactured product
	• Selection of materials and components based on defined criteria such as price and performance
	• Investigation, team work (including brainstorming), research, modelling, prototyping and trialling
	• The process of innovation - collaborative and commercial approaches; the development of innovative product solutions (solutions showing innovative use of materials and/or manufacturing processes)
	• Techniques including inversion, morphological analysis, analogy and lateral thinking
	• Analysis and exploration of the needs of users
	• Reverse engineering, to include historical influences, technological performance and components, functional success and aesthetic detailing, or other techniques for:
	  • product analysis
	  • performance modelling and prototyping
	  • the influence of equipment on product manufacture in a range of materials
	  • interaction of new technologies and design needs especially on material and fabric development

(b) The requirements for product design, development and manufacture, including: fitness for purpose; meeting the criteria of specifications; accuracy of production	• The generation, development and expression of ideas to meet stated requirements • Development of aesthetic values • Fitness for purpose • User centred design: the investigation and analysis of a problem within a context, the needs wants and values of users to define a design specification • Writing appropriate and effective specifications • The generation of specific, measurable performance criteria to inform designing and evaluating • Communication of ideas and solutions in appropriate contexts using a variety of media, such as freehand sketching, formal working and presentation drawings, 2D and 3D modelling, ICT generated images

(c) Appropriate use of digital technologies; aesthetics; ergonomics and anthropometrics; the use of media, communication and presentation techniques, including drawing and sketching, and writing reports to record, explain and communicate their design decisions, providing sufficient information to enable others to interpret their design intentions	• Use of Computer Aided Design (CAD) both in formative and summative stages of designing, • Presenting ideas and design possibilities in appropriate formats such freehand sketching, formal working or presentation drawings, CAD/ICT generated images and solid modelling • Recording and explaining design decisions • Communicating information unambiguously to enable others to interpret design intentions, using appropriate conventions and technical language, digital or conventional pictures/images • The importance of ergonomics and anthropometrics to the designer, manufacturer and user
(d) Digital design and digital manufacture, including computer aided design (CAD)/computer aided manufacturing (CAM), modelling and simulation	• Software programs and the transfer of information to run Computer Aided Manufacture (CAM) machines, e.g. laser cutters, micro-routers, embroidery machines, Computer Numerical Control (CNC) lathes and milling machines • The benefits and limitations of computer controlled machines, to include Computer Aided Design (CAD), CAM, Computer-Integrated Manufacturing (CIM), digital media, including visualisations, rendering and photo-quality imaging/modelling
(e) Safe working practices, including identifying hazards and understanding the need for risk assessments	• Working accurately, creatively, innovatively and imaginatively with materials, components, appropriate technologies, tools, processes and resources to achieve high quality products which match their specification • Commercial working practices and responsibilities and their application to project work • Five-step risk assessment (identify hazard, who might be harmed and how, evaluate potential for risk, record, review if details change) • Provision of equipment, training and signage
(f) How skills and knowledge from other subject areas, including mathematics and science, inform decisions in design and the application or development of technology.	• How skills and knowledge from subjects such as mathematics, physics, chemistry and computer science can be utilised to support problem solving, including the application of technology

2.2 Core technical principles (A level)

The following technical principles apply to all endorsed areas

Learners are required to develop knowledge and understanding of:

Content	Amplification
(a) The main features of manufacturing industries, including stages of production, quality assurance and quality control, modern manufacturing methods and systems when combining or processing materials, sustainability, and services to the customer including legal requirements	• Principles of industrial manufacturing systems across a range of scales of production to include mass, batch, one-off • Staffing needs, allocation of costs, Just in Time (JIT) manufacture and commercial liability • Bought-in, standardised part assembly, sub-contracting • The use of different levels of production taking into account economic decisions • Unit / one-off (including prototyping), modular/batch and high volume production • Sustainability issues, resource management and influencing the future • The need to offer product support and customer services, and take account of consumer group opinions in a competitive market • The impact of legislation / regulations related to product design, manufacture and retail
(b) The regulatory and legislative framework for health and safety and the impact on designing and making	• How the regulatory and legislative framework in the Health and Safety at Work Act (HASAW) sets out duties of employees and employers in manufacturing environments, including: o Control of Substances Hazardous to Health (COSHH) o Personal Protective Equipment at Work Regulations (PPE)
(c) The use of feasibility studies on the practicability of proposed solutions to problems	• The benefits of feasibility studies to find out the extent to which factors such as likely demand, cost of manufacture, availability of materials and competitors' products will influence the commercial viability of a product
(d) Design for manufacturing, repair or maintenance, and product life	• Developing initial design briefs and specifications that may need a specific focus such as: manufacturing, maintenance and product life.
(e) How to achieve an optimum use of materials and components by taking into account the relationship between material cost, form, and manufacturing processes, and the scale of production	• When designing products, designers need to be aware and consider the relationship between material cost, form, manufacturing processes; the scale of production; the environmental factors affecting disposal of waste

(f) The implications of intellectual property, registered designs, registered trademarks, copyright, design rights and patents	• Intellectual Property - Patents, Registered Designs, Design Right, Registered Trade Marks, Copyright and the protection afforded by each • The importance and impact of international standards on the design of products, including British Standards Institute (BSI) and International Organization for Standardization (ISO)

(g) The role of marketing, enterprise, innovation and collaboration in the development of products	• Needs and demands of consumers, technology-push and market-pull
	• The totally new (radical) product and the product which has been subjected to improvements over time (incremental)
	• Marketing strategies and how market research is conducted
	• The process of market research and its place in the process of innovation
	• The market environment, who buys, lifestyle changes, market segmentation
	• Technological trends and how market research is conducted
	• The four Ps
	  • Product
	  • Price and how it is determined
	  • Place and how products are distributed
	  • Promotion of the product
	• How the digital world affects the four Ps

2.3 In-depth technical principles

2.3.1 Engineering design (AS and A level)

Learners are required to develop knowledge and understanding of:

Content	Amplification
(a) System design processes and methods	• The generation, development, expression of ideas, aesthetic values and fitness for purpose • The use of flow charts, ladder logic, circuit diagrams, block diagrams, schematic diagrams within the iterative design process
(b) The use of 'blue sky' and incremental innovation, and of new/emerging technologies	• Appreciate the importance of innovation in both designing and making • The potential benefits of use blue sky thinking, looking at product briefs with a fresh approach, not accepting the norm • How new and emerging technologies can have an effect on the design and marketability of a product i.e. technology pull and market push • Incremental changes to technology products feeding the market – encouraging consumers to upgrade frequently
(c) Visualisation and simulation including the application of computer aided design (CAD) and computer aided engineering (CAE) software	• Use of Computer Aided Design(CAD) both in formative and summative stages of designing for circuit and PCB layout • Internet, applications and control programs, as appropriate to the task undertaken • The principles of concurrent engineering • Computer Aided Engineering (CAE) application and simulation • Product data management - using software to manage and monitor production flow
(d) The characteristics and working properties of materials relevant to engineering including smart and modern materials	• The nature and working characteristics of a range of materials suitable for constructing control systems and products, including Printed Circuit Boards (PCB) conductors and insulators • Materials suitable for producing enclosures for electronic systems, including polystyrene, Acrylonitrile butadiene styrene (ABS) and High Impact Polystyrene (HIPS) • The structural and mechanical properties of a range of common timbers, metals and plastics including carbon fibre sufficient to manufacture reliable products and / or prototypes • Semi-conducting materials and the way in which these materials are able to conduct an electrical current or prevent it from flowing, usually silicon and found in components like diodes, transistors and Integrated circuits (ICs) • Specific material properties related to their function in a component for example, gold in connectors, gallium arsenide in semi-conductors, ceramics in transducers, piezzo crystals (LEDs)

(e) The principles of electronics including sensing, control, and output systems	• Basic components to include: resistors (fixed and variable), transistors, capacitors and diodes (including LEDs) • Input devices to include switches, reactive switches Light Dependant Resistors (LDRs), thermistors and variable resistors • Control devices to include operational amplifiers, timers and logic gates • Output devices to include relays; lamps, Light Emitting Diodes (LEDs), motors, buzzers and displays, solenoid valves
(f) Static and dynamic forces in structures, including the forces of: tension, compression, torsion and bending; stress, strain and elasticity; rigidity and modes of failure	• Static and dynamic forces in structures, the difference between the two forces. • Tension forces, compression forces, torsion (the twisting action of a force) and bending that occurs in simple objects due to the action of a force i.e. the bending of a beam in a simple bridge • Stress and strain Be able to apply the equations to objects that are under tension or compression loading. Stress = $\frac{\text{Change in length}}{\text{Original length}}$ Stress = $\frac{\text{Load}}{\text{Area}}$ • Young's modulus of elasticity stress / strain graphs for mild steel and glass. Rigidity and modes of failure.
(g) Mechanical systems	• Basic components to include spur and bevel gears in simple and compound trains, belts and pulleys, sprocket and chains, rack and pinion, worm and worm wheel, ratchet and pawl • Calculation of mechanical advantage (MA) and velocity ratio (VR) of gear and pulley systems • The use of plain, ball and roller bearings • Rack and pinion, crank and slider mechanisms • Simple clutch systems used to transmit drive • Cams and followers • The application of shafts and couplings in specific mechanical control systems • Classification of levers, application of load, effort and fulcrum to systems involving levers • The use of the above components in the design of 'black box' systems to achieve desired relationships between input and output motion

(h) Energy sources, energy storage, transmission, and utilisation	• The benefits and limitations of various sources of energy to include, fossil fuels, nuclear fuels, solar, hydro and wind generation • The efficient use of energy in manufacturing • Green/environmental issues (implications of the industrial/technological age) • Sustainability issues - influencing the future, resource management • Energy conservation, including recycling/green issues • The effect of energy costs on the final product • Appropriate technology
(i) Programmable and control devices including how to use such devices to solve problems in system design	• Control devices to include operational amplifiers, timers and logic gates • Output devices to include relays; lamps, Light Emitting Diodes (LEDs), motors, buzzers and displays, solenoid valves • How to use such devices in systems design
(j) How to represent systems and components through the use of circuit diagrams, flowcharts and constructional diagrams	• Flow charts, ladder logic, circuit diagrams, block diagrams working/manufacturing drawings
(k) How to develop and use production plans	• Consider the structure, formation and development of production suitable for project development. • Analyse production plans used in the manufacturing industry • Gantt charts

2.3.2 Engineering design (A level)

Learners are required to develop knowledge and understanding of:

Content	Amplification
(a) Industrial and commercial practice including manufacturing processes and systems, the use of ICT, prototyping, product manufacture and maintenance, production scales, and quality control in relation to the engineering industries	• Principles of industrial manufacturing systems across a range of scales of production to include mass, batch, one-off • Staffing needs, allocation of costs, Just in Time (JIT) manufacture and commercial liability • Bought-in, standardised part assembly, sub-contracting • The use of different levels of production taking into account economic decisions • Unit / one-off (including prototyping), modular/batch and high volume production • Primary and secondary processing • Sourcing of materials, the buying cycle, forward ordering, storage, processing, assembly, finishing, packaging, labelling and transportation • Comparison of hand and commercial methods of preparing, shaping, cutting/wasting, joining materials, circuit board production, population and soldering • The influence of the above on the time taken to produce the product, its quality and final cost • Knowledge of manufacturing through analysis of products • Internal Quality Control (QC) and external Quality Assurance (QA) requirements • Project management systems including flow charts and critical path analysis • Modern methods of labour organisation to include single craft, progressive bundle and cell • Total quality manufacturing methods
(b) How to interface electrical/electronic circuits with mechanical and pneumatic systems and components	• The use of microprocessor and smart cards, microprocessor modelling systems, computer interface devices to produce microprocessor controlled products and/or systems, including mechatronics • The interfacing of basic electronic input and output components
(c) Communication protocols, including an understanding of interfacing with wireless devices, embedded devices, and smart objects	• Interfacing wireless devices including Bluetooth and Wi-Fi • Networking devices to exchange information

(d) Product lifecycle management, engineered lifespans including planned obsolescence, the need for maintenance of machinery, product support, and end of life (EOL)	• How manufactures review and look at product life cycle management • The implications of planned obsolescence to the consumer and the manufacturer • End of Life (EOL) time frames of products and issues raised when a product reaches the end of its life / ceases to be produced, including technical support, availability of spare parts and disposal
(e) How testing, including the use of destructive and non-destructive methods, is used to inform and modify designs	• Testing the performance of products against specified criteria and acting on the findings • Ensuring, through testing, modification and evaluation, that the quality of products is suitable for the intended user/market
(f) The prediction of performance through modelling, including the use of Information Technology (IT) based tools	• The use of Information Technology (IT) based modelling when production and testing of physical models is prohibitively expensive and/or dangerous

2.3.3 Fashion and textiles (AS and A level)

Learners are required to develop knowledge and understanding of:

Content	Amplification

(a) The characteristics and working properties of materials relevant to fashion and textiles design, development, and manufacture	• Construction methods and how their advantages and disadvantages affect end use
	• Weaving: plain, twill, satin, herringbone, pile
	• Knitting: weft knit and a warp knit
	• Bonding: sticking with adhesives, heating thermoplastic, fibres and, stitching of fibres
	• Laminating
	• Felting
	• Quilting
	• Fibres are the raw material of textiles and they can be classified according to their source
	• The nature of staple and continuous filaments, textured yarns, novelty yarn (chenille) and these determine fabric weight, flexibility, handle and end use
	• The properties of the main natural and manufactured fibres/fabrics including: strength, elasticity, absorbency, durability, insulation, flammability, water repellence, anti-static and resistance to acid, bleach, sunlight
	• Components:
	  • Fastenings: Zips, buttons, buckles, Velcro, eyelets, ties, press studs
	  • Threads: embroidery, sewing, overlocker, conductive
	  • Trims: lace, braids, ribbon, tapes, cords, elastics, support (boning etc.), beads, sequins, lights (LEDs)

(b) The sources and classification of the main fibre groups, fabrics and yarns	• Classification, general characteristics and uses of:
	• Natural polymers:
	  • Animal: wool/fleece, mohair, cashmere, angora, alpaca, camel, llama (hair)
	  • Insect polymers: silk
	  • Plant polymers: cotton, linen, hemp, jute, bamboo, soya, banana
	• Manufactured polymers:
	  • Regenerated: viscose, rayon, acetate, lyocell (Tencel®)
	  • Synthetic: polyester, polypropylene; nylon (polymide); elastane; lycra, aramid fibres
	  • Microfibres to include tactel, tencel and lyocel
	• Stock forms of the above materials to include: textile materials that are made by different construction methods - weaving, knitting, bonding, laminating, felting
	• Textile materials come in standard widths 90cm, 115cm, 150cm, 200cm, 240cm.
	• Costs, sizes and quantities for components

(c) The production processes associated with mixtures and blends	• Combining textile materials to improve their properties and uses
	• Blending and mixing fibres
	  • Blending and mixing fibres to improve the properties and uses of yarns and materials
	  • Blends, for example: polyester and cotton, silk and viscose, hemp and cotton or silk
	  • Mixture, for example cotton and wool, lycra with wool cotton or nylon
	  • Bonding foam to knitted or woven fabrics
	  • Bonding plastic to loosely woven cotton to simulate leather
	• Microfibres
	• Performance fabrics and metallised materials

(d) Laminating as a finishing process	• The process of laminating to bond a film to a textile material • bonding breathable water proof membranes to outer fabrics (Gore-Tex [hydrophilic membrane], Permatex, Sympatex) • the advantages of fabrics combined as laminates in clothing, furnishings, geotextiles, agriculture, sport and leisure, and medical • Coating and laminating textiles to add or improve function to the material, or to create a material with specific properties, for example: coated cotton, PVC

(e) Methods of joining fabrics including the use of fastenings	• Including the use of an overlocker, sewing machine, pins, zips, buttons, velcro, ties and toggles, buckles, appropriate to the material and the intended purpose.
	• Permanent and temporary means of joining fabrics for example:
	  • The appropriate choice of construction and decorative processes for fabric type and product end use
	  • Joining: seams – plain, French, double stitched, flat fell, lapped, over-locked, bound; neatening methods, tacking, stay stitching
	  • Shaping: darts, princess line seams, gathers, tucks, pleats, casings (draw cord/elastic), use of elastic
	  • Finishing edges: hems (types of); facings, piping, frills, binding

(f) The working properties and physical characteristics of fibres and fabrics in relation to their suitability for various products	• The physical working properties of a range of textile material to include: tensile strength, elasticity, absorbency, thermal, flammability, durability, crease resistance, water repellence, anti-static, resistance to acid, bleach and sunlight

(g) The performance characteristics of fibres and fabrics including tensile strength, elasticity, resilience, durability, flammability, and weight	• Textile materials reflect the characteristics of the fibres and yarns they are made from - staple and continuous filaments all affect the fabric weight, flexibility, handle drape, density and end use
	• Appreciation of the complex interrelationships between:
	  • material, form and manufacturing process
	  • how the material affects the structure of the fashion/textiles product

(h) The qualities given to fabrics by the construction methods used, finishes and surface decoration, and through surface pattern technologies	• Construction methods for example: knitted or woven
	• Finishing techniques including both self-finished and applied finishes and different methods of enhancing the appearance, prolonging and protecting life
	• Finishes used to:
	  • enhance aesthetic quality (such as colouring, surface decoration, embossing, glazing, brushing, sublimation transfer printing, stain resistance)
	  • enhance fabric life (such as flame retardant, moth proofing)
	  • improve functionality (such as shower and waterproofing, shrink resistance, crease resistance, coating with Polyvinyl Chloride (PVC), anti-static finish)
	  • Appropriate surface treatments and finishes that can be applied for aesthetic purposes for example: dyeing, printing, embellishing – embroidery, engraving

(i) The applications of smart materials, e-textiles, and technical textiles	• Micro and Nano technology in fibre and material production for a range of fashion/textile products • How fashion/textile product development is influenced by modern materials, to include an understanding of a range of composites, functional (SMART) materials, which change their shape or properties in response to various stimuli • Interactive textiles that function as electronic devices and sensors: wearable electronic fashionable garments and textile products; electronic systems integrated into fabrics (e.g. GPS); conductive fibres and yarns; conductive polymers; heat storage material; optical fibres • The impact of biotechnology; micro-encapsulation • Geotextiles for landscaping and agriculture • Medical textiles: sun protective clothing, Rhovyl as an antibacterial fibre • Kevlar (modular compression engineering); biodegradable fibres (recycling Polyethylene Terephthalate (PET) bottles into fleece), carbon fibres, Nomex and biosteel
(j) How materials, other than fibres and fabrics, can be used in textiles and fashion design and development	• Bought-in components, electro-conductive materials, plastics
(k) A variety of components and their appropriateness for a range of products in relation to the end-user, fabrics used, and design considerations	• The availability and use of a wide range of bought-in components and fittings appropriate to the material(s) and application including related products such as stationery, footwear, notebooks and wallpaper

2.3.4 Fashion and textiles (A level)

Learners are required to develop knowledge and understanding of:

Content	Amplification
(a) Industrial and commercial practice including manufacturing processes, the use of Information Control Technology (ICT), pattern cutting, product manufacture, re-use and recycling, production scales, testing systems, and quality control in relation to textiles and the fashion design industry	• Use of Computer Aided Manufacture (CAM), for preparation of stencils, templates, pattern blocks • Use of Computer Numerical Control (CNC) miller for preparation of printing blocks • Use of Computer Numerical Control (CNC), embroidery machines, laser cutters and 3D printers for design work on a range of fashion/textiles products • The benefits and limitations of computer controlled machines to include Computer Aided Design (CAD), Computer Aided Manufacture (CAM), Computer-Integrated Manufacturing (CIM), digital media • Principles of industrial manufacturing systems across a range of scales of production to include mass, batch, one-off • Bought-in, standardised part assembly, sub-contracting • The use of different levels of production taking into account economic decisions • Unit / one-off (including prototyping), modular/batch and high volume production • Products can be manufactured in quantity • Different methods of manufacture: job production (custom-made, bespoke or one–off); batch production; mass production and when each is appropriately used • Differentiate between street styles: contemporary fashion; ready to wear (prêt-à-porter); haute couture and the most appropriate scale for production • The scale of production depends on the quantity of products required • How manufacturing systems are organised: line production, progressive bundle system and cell production • Understand the role of designers, image makers, trendsetters, fashion centres, fashion forecasting and predictions in the commercial development of fashion products • Primary and secondary processing • Sourcing of materials, the buying cycle, seasonal influences, influences on current trends such as fashion shows, forward ordering, storage, processing, assembly, finishing, packaging, labelling and transportation • Comparison of hand and commercial methods of production, for example hand embroidery / beading in comparison with commercial methods. • The influence of the above on the time taken to produce the product, its quality and final cost • Internal Quality Control (QC) and external Quality Assurance (QA) requirements • Project management systems including flow charts and critical path analysis • Modern methods of labour organisation to include single craft, progressive bundle and cell • Total quality manufacturing methods

(b) The use of pattern drafting and toiles	• Their use in developing models, testing and communicating ideas to clients. • The basic procedures for lay planning and use of pattern language • Lengthwise / crosswise folds, cutting on the cross or bias, notches, grain lines, balance marks, tuck / pleat lines, dart markings, positions for pockets, buttons / holes, centre front / back lines and seam tolerance • Different methods of transferring important marks onto material prior to product manufacture • Tailor's chalk • Hot notch marking in industry • Different types of cutting tools and equipment used industry and know why they are used • Cutting tools • Straight knives, round or band knives, automated die cutters for products of constant shapes, computer controlled cutting machines and laser cutters • Other equipment used for: lay planning and estimating material quantities, fabric spreading to include several plies

2.3.5 Product design (AS and A level)

Learners are required to develop knowledge and understanding of:

Content	Amplification
(a) The characteristics and working properties of materials relevant to product design and manufacture, including: metals, woods, polymers, textiles, composites, smart and modern materials	• The characteristics and working properties of: • Natural materials and elements to include, hardwoods, softwoods • Plastic/pure synthetic materials to include, acrylic, cellophane, epoxy resin, kevlar, polyamide (nylon), polyester, Polytetrafluoroethylene (PTFE), polypropylene, polyvinyl chloride (PVC) • Regenerated materials to include, blockboard, cellulose-based boards (cards), chipboard, medium density fibreboard (MDF), paper • Alloys and composites to include, aluminium alloy, brass, pewter, bronze, carbon fibre, glass reinforced plastic (GRP), low and medium carbon steels • Stock forms of the above materials to include, bonded, laminated, profiled, sheet and woven forms, availability and comparative costs • Current developments of new materials and alloys together with their application, including SMART materials; foams, rubbers, wood-based composites and metallised materials
(b) The use of adhesives, permanent, and semi-permanent fixings	• The availability and use of a wide range of bought-in components and fittings appropriate to the material(s) and application • Temporary means of joining/fastening a broad range of materials • Joining and forming of a wide range of materials within modern industry for different levels of production • Laminating, combining, jointing, folding and other methods of reinforcing • The use of adhesives in manufacturing including in the car industry
(c) The use of surface finishes and coatings to enhance appearance, and methods of preventing corrosion and decay such as paints, varnishes, sealants, preservatives, anodising, plating, coating, galvanization and cathodic protection	• The surface finish to materials has two basic roles, to improve the look or to act as a method of preventing decay or corrosion • Metal surface treatment finishing processes: plastic coating, enamelling, oil finishing black steel, paint and primer • Methods of preventing corrosion in metals such as galvanizing/plating, anodising aluminium and cathodic or sacrificial protection of steels • Surface treatments of natural timber and manufactured: sealants and primers. Finishes for aesthetic or functional reasons: varnish, wood stains, oils and polishes • Preservative paints/oils to reduce decay • Self-finishing nature of many thermosetting and thermoforming plastics. Textured finishes of plastics

(d) The performance characteristics of woods, metals, and polymers including toughness, hardness, elasticity and durability in relation to specific product applications	• The performance characteristics of a range of materials, to include conductivity, relative hardness, density, toughness, ductility, elasticity, durability, tensile and compressive strength, malleability, as appropriate to the material and application in question • The complex interrelationships between material, form and manufacturing process and how the material affects the structure of the product
(e) The application of smart and modern materials	• How product development is influenced by modern materials, to include a range of composites, functional (SMART) materials, which change their shape or properties in response to various stimuli, including shape-memory alloys and polymers, electro-chromic and photo-chromic materials
(f) Production processes including moulding, extrusion, laminating, milling, turning, casting, stamping, and forming; the use of ICT, prototyping, jigs and fixtures	• The main features of and the advantages and disadvantages of production processes including moulding, extrusion, laminating, milling turning, casting, stamping, forming, injection moulding, blow moulding, composting, combining, laminating and reforming • Methods of cutting/wasting, industrial forming (a range of materials) • Joining and finishing a variety of materials such as casting, laminating, bonding • The use of jigs and fixtures to increase speed of production and help ensure consistency • Prototyping before entering full-scale production

2.3.6 Product design (A level)

Learners are required to develop knowledge and understanding of:

Content	Amplification
(a) Industrial and commercial practice including manufacturing processes and systems, product manufacture and maintenance, production scales, and quality control in relation to manufacturing and the design industries	• The main features and the advantages and disadvantages of manufacturing processes for mass, batch and small-scale production • How designers take into account manufacture, scale of production and in-service maintenance of products • Quality management, quality control and quality assurance systems and how these can help: • reduce costs for the manufacturer • ensure products sold are of an appropriate quality • enhance the reputation of companies • Principles of industrial manufacturing systems across a range of scales and levels of production to include mass, batch, one-off and different product types, repetitive flow production, progressive bundle system, unit production system, cell production • Staffing needs, allocation of costs, 'Just in Time' manufacture and commercial liability • Bought-in, standardised part assembly, sub-contracting • The effect of production across manufacturing sites. • Techniques of evaluating performance against specific measurable criteria such as comparative testing of materials for a specific application; • 2D/3D modelling and prototyping to evaluate proposals • Identification of criteria for value judgements such as ratings charts for aesthetics, function, user-friendliness.

(b) Modular/cell production systems, just-in-time manufacturing, bought-in parts and components and the use of standardised parts	• The advantages and disadvantages of:
	  • Modular/cell production systems
	  • Just-in-time manufacturing
	  • The use of bought-in parts and components in comparison with in-house production
	  • The use of standardised parts
	from the perspective of the designer, manufacturer and end-user.

(c) Rapid prototyping.	• The main processes for rapid prototyping including 3D printing, selective laser sintering and stereo lithography • The benefits and limitations of rapid prototyping to large and small manufacturers of a broad range of products

2.4 Core design and making principles (AS and A level)

The following design and making principles apply to all endorsed areas

Within their endorsed area, learners are required to develop knowledge and understanding of:

Content	Amplification
(a) User-centred design: the investigation and analysis of a problem within a context, and the needs, wants and values of users, to define a design opportunity or problem leading to the production of a design brief and specification to direct, inform and evaluate their design practice	• User centred design including means of obtaining views and analysing feedback, the investigation and analysis of a problem, the needs wants and values of users to define a design opportunity or problem that could lead to the production of a design brief and specification • Writing appropriate and effective specifications • The generation of specific, measurable performance criteria to inform designing and evaluating

(b) Design theory, including key historic movements/figures and their methods	• Design theory, key historic movements, noted practitioners, their influence and methods including:
	  • Engineering Design: Jonathan Ive and James Dyson
	  • Fashion and Textiles: Julien MacDonald and Issey Miyake
	  • Product Design: James Dyson and Bethan Gray
	Learners should only study the work of the practitioners related to their chosen endorsed route.

(c) The application of knowledge and understanding in a product development process to design, make and evaluate prototypes/products	• Using knowledge and understanding of technical principles when designing, making and evaluating prototypes.
(d) How the appraisal of technological developments, both current and historic, needs to take into consideration social, moral and ethical factors and how these can impact on the work of designers and technologists	• The development of products through time - recognising 'design classics' or 'icons' • Development of a design consciousness in society; levels of technological development (including new materials and technologies) and their influence on designing and products • Global manufacturing • The historical influences on selected products • The comparison of 'new' products with existing types; cultural trends and differences and their effects on new product development • Ethical, moral, sustainability and social considerations

(e) How to critically analyse and evaluate their own ideas and decisions whilst using iterative design and make processes	• Evaluating outcomes by devising quality assurance procedures, assessing the impact of actions and regularly reviewing and establishing the best approach. • Using and selecting methods of testing the performance of products against specified criteria and acting on their findings. • Ensuring, through testing, modification and evaluation, that the quality of their ideas/prototype(s) are suitable for the intended user.
(f) In relation to the focus area, how to select and safely use a range of specialist tools, techniques, processes, equipment and machinery appropriate to the design and manufacture of domestic, commercial and industrial products and systems	• Methods of testing, conditioning, cutting/wasting, forming and finishing a wide variety of materials, including casting, laminating, injection moulding, bonding • The use of templates, patterns and guides • The use of jigs and fixtures to increase speed and/or quality of production and help ensure consistency in terms of dimensions, features, assembly • Joining and forming of a wide range of materials for different levels of production • Laminating, combining, jointing, folding and other methods of reinforcing • Software applications and the transfer of information to Computer Aided Manufacture (CAM), machines, e.g. laser cutters, micro-routers, Computer Numerical Control (CNC) lathes and milling machines
(g) How to measure, determine, and apply the degree of accuracy and precision required for products to perform as intended	• Recognising the importance of accurate measuring and tolerances in the processes of designing and making, to help ensure a high-quality outcome that performs as intended
(h) How to evaluate their prototypes/products taking into account the views of potential users, customers or clients	• Use personal sources and external sources – target audience, specialists, when evaluating products/products against performance specification.

2.5 Core design and making principles (A level)

The following design and making principles apply to all endorsed areas

Within their endorsed area, learners are required to develop knowledge and understanding of:

Content	Amplification
(a) A range of strategies, techniques and approaches to explore, create and evaluate design ideas, such as user-centred design, circular economy, and systems thinking	• The main features of the techniques of user-centred design, circular economy, and systems thinking
(b) Approaches to project management, such as critical path analysis, scrum or six sigma	• The main features of different approaches to project management when faced with projects of varying complexity, such as critical path analysis, scrum and six sigma
(c) Design for manufacture, including planning for accuracy and efficiency when making prototypes and making recommendations for small, medium and large scale production	• Managing time and resources effectively, responding to changing circumstances • Exercising entrepreneurial, collaborative and team working skills as appropriate • Identifying and applying relevant external standards, such as British Standards Institute (BSI), Institution of Electrical Engineers (IEE) • Achieving optimum use of materials and components by taking into account the complex relationship between: material, form and manufacturing processes; the scale of production
(d) The environmental factors affecting disposal of waste, surplus materials, components and by-products, sustainability, and costs	• How to achieve optimum use of materials and components by taking into account the complex relationship between material, form and manufacturing processes; the scale of production; the environmental factors affecting disposal of waste, surplus and by-products; and the cost of disposal • Sustainability issues - influencing the future, resource management • Energy conservation, including re-cycling/green issues • The effect of energy costs on the final product
(e) The application of relevant standards to their design tasks including those published by the British Standards Institute (BSI) and the International Organisation for Standardisation (ISO) specific to the subject;	• How to find relevant information related to a product's design and use from sources such as Health and Safety legislation, British Standards Institute (BSI) and Control of Substances Hazardous to Health (COSHH) (for example, microwaves generated by ovens and mobile phones)
(f) The stages of a product life cycle.	• Introduction – researching, developing and then bringing a product to market • Growth – when sales are increasing • Maturity – sales are near their highest point • Decline – sales begin to fall • Obsolescence – no longer produced.

3 ASSESSMENT

3.1 Assessment objectives and weightings

Below are the assessment objectives for this specification. Learners must demonstrate their ability to:

AO1
Identify, investigate and outline design possibilities to address needs and wants

AO2
Design and make prototypes that are fit for purpose

AO3
Analyse and evaluate –
- design decisions and outcomes, including for prototypes made by themselves and others
- wider issues in design and technology

AO4
Demonstrate and apply knowledge and understanding of –
- technical principles
- design and making principles

The table below shows the weighting of each assessment objective for each component and for the qualification as a whole.

	AO1	AO2	AO3	AO4	Total
Unit 1	-	-	4%	16%	20%
Unit 2	6%	10%	4%	-	20%
Unit 3	-	-	6%	24%	30%
Unit 4	9%	15%	6%	-	30%
Overall weighting	**15%**	**25%**	**20%**	**40%**	**100%**

3.2 Arrangements for non-exam assessment

Assessment criteria for the design and make project

The assessment criteria for Unit 2 (design and make task) and Unit 4 (design and make project) are summarised in the tables below and shown in detail in Appendix A and Appendix B respectively.

Unit 2 – design and make task

Assessment Criteria		Marks	Assessment objective
(a)	Identifying and investigating design possibilities	12	AO 1
(b)	Developing a design brief and specification	12	
(c)	Generating and developing design ideas	20	AO 2
(d)	Manufacturing a prototype*	20	
(e)	Analysing and evaluating design decisions and prototypes	16	AO 3
	Total	80	

Unit 4 – design and make project

Assessment Criteria		Marks	Assessment objective
(a)	Identifying and investigating design possibilities	15	AO 1
(b)	Developing a design brief and specification	15	
(c)	Generating and developing design ideas	25	AO 2
(d)	Manufacturing a prototype*	25	
(e)	Analysing and evaluating design decisions and prototypes	20	AO 3
	Total	100	

* *In the context of these units, 'prototype' is used to describe all working solutions including products, models and systems.*

The design and make task is worth 20 per cent of the total marks available for the A level qualification (and 50 per cent of the AS).

The design and make project is worth 30 per cent of the total marks available for the A level qualification. The design and make task and the design and make project are assessed by the centre and moderated by WJEC.

Design and make task

Learners are required to complete **one** design and make task, based on a design brief developed by the learner. Approximately 40 hours should be devoted to this task.

Design and make project

Learners are required to complete **one** sustained design and make project, based on a design brief developed by the learner. Approximately 60 hours should be devoted to this project.

In completing the design and make task and the design and make project, the learner will be required to produce the following evidence:

- a design brief developed by the learner
- a final prototype (or prototypes) based on that design brief, and
- additional evidence as necessary, including an A3 design portfolio, to enable the assessment of the learner's attainment in each of the categories (a) to (e) in the table above
- the portfolio should be in the form of A3 single-sided sheets of paper or in the form of an electronic document.

Learners should be encouraged and supported to select NEA tasks/projects in which they are interested and which are neither under nor over ambitious. The teacher should discuss the proposed focus of the task/project with the learner, considering the requirements of the assessment and the ability and interests of the individual learner. The teacher must be satisfied that the suggested focus has the potential for the individual learner to:

- identify and investigate design possibilities
- develop a design brief and specification
- generate and develop design ideas
- manufacture a prototype
- analyse and evaluate design decisions and prototypes.

This will help ensure the task/project is at a suitable level for the learner concerned and will provide that individual with a level of challenge that is appropriate to their abilities, in the context of the requirements of an AS or A level Design and Technology qualification.

There is no restriction on the use of materials in the NEA. A learner entered for the endorsed area of product design for example, may use electronic components and/or textile materials within their prototype. It is important to bear in mind, however, that questions on materials and processes in the written examinations will be specific to the endorsed area. So learners need to have an appropriate level of knowledge and understanding of endorsed-area specific materials and processes, in addition to those where their NEA work has provided direct experience.

A level candidates are not allowed to resubmit any work from the AS design and make task (Unit 2), use it as a starting point or extend the work to address the requirements of the A level design and make project (Unit 4). The design and make project for Unit 4 must be distinct from and must not build upon the design brief/prototype produced for Unit 2. Candidates will be required to complete a declaration to this effect on the cover sheet for Unit 4.

Supervision

The design and make task and the design and make project must be appropriately supervised to ensure that assessors are able to confidently authenticate each learner's work.

Design and make activity should be carried out in the normal design and technology classroom/workshop environment. Learners are allowed supervised access to resources that may include information gathered outside of school/college.

Each learner must produce their final prototype or prototypes under *'immediate guidance or supervision'.* This means the prototype(s) have to be produced either:

(i) with the simultaneous physical presence of the learner and the supervisor, or
(ii) remotely by means of simultaneous electronic communication.

In most cases supervision will be of the form described in (i), but in some circumstances, for example if the learner is carrying out a specialist process away from the centre, (ii) may be more appropriate.

The supervising teacher may give learners limited guidance during the design and make project in order to clarify what is to be done and to ensure that safe working practices are followed. However, any guidance given must be taken into account when assessing the work.

Limited guidance refers to giving general advice to:

- support the learner only;
- ensure that the learner knows the exact requirements of the whole design and make task/project i.e. design folio of evidence, models, times etc.
- ensure that the learners route through the NEA will meet the requirements of the marking criteria and be of sufficient demand to achieve the marks from the highest bands;
- enable the learner to feel comfortable in using the iterative process within the design and make task;
- ensure that all work being completed during the iterative journey is that of the learner. Where design work has been taken outside of the school environment, the teacher must monitor periodically to validate that the work being produced is solely that of the learner;
- ensure safe storage and security of all work, to ensure plagiarism does not take place;
- advise on any health and safety issues.

Within limited guidance **you are not allowed to:**

- give the learner detailed advice and take the lead through the NEA process;
- specify the situation/task or brief, it must be the leaner's own decision;
- correct or modify the work of a learner;
- give specific direction to the learner to achieve higher marks;
- produce any form of writing frame within a design portfolio;
- initially mark work and then return the work to the learner to improve;
- return the work to the learner once it has been submitted for marking and final marking has taken place ready for submitting to the board.

Where a teacher has had to give detailed guidance advice and support to the learner this **must be declared in writing by the centre** and marking of the work should be adjusted to reflect this support.

All practical work should be completed within the school or college under the guidance or supervision of the teacher. The final prototype should be completed within the school or college and not be allowed to be taken home at any point. Where a specific making process needs to be done outside the establishment, a declaration of the work completed will need to be submitted with the work and also reflected within the marking.

It is the responsibility of the centre to ensure the authenticity of all work presented for assessment. All learners are required to sign an authentication statement endorsing the originality of their work presented for assessment, and assessors must countersign that they have taken all reasonable steps to validate this. Authentication documentation must be completed by all learners, not just those selected for moderation.

All assessors who have marked learners' work must sign the declaration of authentication to confirm that the work is solely that of the learner concerned and has been conducted under the required conditions. Centres must ensure that the authentication documents are completed for each learner and made available to the moderator.

Instructions for non-exam assessments are provided by JCQ. These inform the operational practices required during non-exam assessment sessions. The head of the school or college is responsible for making sure that supervision and authentication is conducted in line with JCQ instructions and those laid out in this specification.

Assessment

The design and make task is assessed using the criteria shown in Appendix A.

The marks awarded will arise by matching the learner's performance in the design and make project to each of the four sets of criteria (targeting AO1, AO2 and AO3) and then deciding upon the extent to which the learner has demonstrated those criteria in their work.

The design and make project is assessed using the criteria shown in Appendix B.

The marks awarded will arise by matching the learner's performance in the design and make project to each of the five sets of criteria (targeting AO1, AO2 and AO3) and then deciding upon the extent to which the learner has demonstrated those criteria in their work.

Beginning at the lowest band, the assessor should consider the learner's work and establish whether it matches the descriptor for that band. If the descriptor at the lowest band is satisfied, the assessor should move up to the next band and repeat this process for each band until the descriptor accurately reflects the work.

If the work covers different aspects of different bands within the assessment criteria, a 'best fit' approach should be adopted to decide on the band and then careful analysis of the learner's work should be made to decide on the mark within the band. For example, if the work is judged to be mainly in band 2 but with a limited amount of band 3 content addressed, the work would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

It is important that learners are not discouraged from attempting challenging tasks/projects and producing innovative solutions. Candidates should be appropriately rewarded for their achievements, however complex/simple their task/project. So a candidate who has attempted a complex task/project, has been innovative in their choice of materials / manufacturing processes and has not been entirely successful could achieve a high overall mark for the NEA unit, when the nature of the task/project is taken into account.

Assessors need to consider the quality achieved in the context of the demands of the prototype. Outcomes do not need to be perfect to achieve full marks, but should reflect the standard expected at GCE AS and GCE A level.

Internal moderation/standardisation

Where there is more than one assessor in a centre, for example, where more than one endorsed area is delivered, the assessment of learners' design and make task must be standardised internally. This is to ensure that the final assessment, whatever the endorsed area, or whoever the assessor, accurately reflects a single agreed standard for all AS and A level design and technology learners entered for assessment by the centre.

Internal standardisation should involve all assessors independently marking sample pieces of work to identify any differences in marking standards. Such differences should be discussed collectively to arrive at an agreed common standard for the centre. Standardising material will be issued by WJEC to assist with this process.

Where there is more than one assessor in a centre, for example, where more than one endorsed area is delivered, the assessment of learners' design and make tasks must be standardised internally. This is to ensure that the final assessment, whatever the endorsed area, or whoever the assessor, accurately reflects a single agreed standard for all GCE design and technology candidates entered for assessment by the centre.

Submission of marks

Centres are required to submit marks for the design and make task and for the design and make project online at the beginning of May of the year in which the unit is to be assessed. When marks have been submitted to WJEC, the online system will apply the sample formula based on the overall rank order for the entry and immediately identify the sample of learners whose work is selected for moderation.

Once learners' design and make tasks and design and make projects have been assessed by the centre and the marks have been submitted to WJEC, learners must not have access to their work for further development and the work must not be removed from the centre.

Moderation

A moderator appointed by WJEC will visit the centre during May in the year in which the unit is assessed. For learners making up the moderation sample (identified in advance of the visit by WJEC) across endorsed areas, their portfolio and prototype(s) must be made available for the moderator.

Moderators will provide detailed feedback to centres through a written report which will be made available on the day results are issued. Adjustments will be made when it is deemed that the centre's internal assessment does not conform to agreed common standards established by WJEC. If centres have concerns about the outcomes of moderation, they may access a range of post-results services as outlined on the WJEC website.

4 TECHNICAL INFORMATION

4.1 Making entries

This is a unitised specification which allows for an element of staged assessment.

Assessment opportunities will be available in the summer assessment period each year, until the end of the life of the specification.

Unit 1 and Unit 2 will be available in 2018 (and each year thereafter) and the AS qualification will be awarded for the first time in summer 2018.

Unit 3 and Unit 4 will be available in 2019 (and each year thereafter) and the A level qualification will be awarded for the first time in summer 2019.

Candidates may resit an individual unit ONCE only. The better uniform mark score from the two attempts will be used in calculating the final overall qualification grade(s).

A qualification may be taken more than once. However, if all units have been attempted twice, candidates will have to make a fresh start by entering all units and the appropriate cash-in(s). No result from units taken prior to the fresh start can be used in aggregating the new grade(s).

There are three endorsed titles at both AS and A level:

- WJEC AS Design and Technology (Engineering Design)
- WJEC AS Design and Technology (Fashion and Textiles)
- WJEC AS Design and Technology (Product Design)

- WJEC A level Design and Technology (Engineering Design)
- WJEC A level Design and Technology (Fashion and Textiles)
- WJEC A level Design and Technology (Product Design)

The entry codes appear overleaf.

	Title	Entry codes	
		English medium	Welsh medium
AS Unit 1	Written paper 1 *engineering design*	2601U1	2601N1
	Written paper 1 *fashion and textiles*	2602U1	2602N1
	Written paper 1 *product design*	2603U1-	2603N1
AS Unit 2	Design and make task *engineering design*	2601U2	2601N2
	Design and make task *fashion and textiles*	2602U2	2602N2
	Design and make task *product design*	2603U2	2603N2
A2 Unit 3	Written paper 2 *engineering design*	1601U3	1601N3
	Written paper 2 *fashion and textiles*	1602U3	1602N3
	Written paper 2 *product design*	1603U3	1603N3
A2 Unit 4	Design and make project *engineering design*	1601U4	1601N4
	Design and make project *fashion and textiles*	1602U4	1602N4
	Design and make project *product design*	1603U4	1603N4
AS Design and Technology (Engineering Design) Cash-in		2601QS	2601CS
A level Design and Technology (Engineering Design) Cash-in		1601QS	1601CS
AS Design and Technology (Fashion and Textiles) Cash-in		2602QS	2602CS
A level Design and Technology (Fashion and Textiles) Cash-in		1602QS	1602CS
AS Design and Technology (Product Design) Cash-in		2603QS	2603CS
A level Design and Technology (Product Design) Cash-in		1603QS	1603CS

The current edition of our *Entry Procedures and Coding Information* gives up-to-date entry procedures.

There is no restriction on entry for this specification with any other WJEC AS or A level specification.

4.2 Grading, awarding and reporting

The overall grades for the GCE AS qualification will be recorded as a grade on a scale A to E. The overall grades for the GCE A level qualification will be recorded as a grade on a scale A* to E. Results not attaining the minimum standard for the award will be reported as U (unclassified). Unit grades will be reported as a lower case letter a to e on results slips but not on certificates.

The Uniform Mark Scale (UMS) is used in unitised specifications as a device for reporting, recording and aggregating candidates' unit assessment outcomes. The UMS is used so that candidates who achieve the same standard will have the same uniform mark, irrespective of when the unit was taken. Individual unit results and the overall subject award will be expressed as a uniform mark on a scale common to all GCE qualifications. An AS GCE has a total of 200 uniform marks and an A level GCE has a total of 500 uniform marks. The maximum uniform mark for any unit depends on that unit’s weighting in the specification.

Uniform marks correspond to unit grades as follows:

		Unit grade				
Unit weightings	**Maximum unit uniform mark**	**a**	**b**	**c**	**d**	**e**
Unit 1 (20%)	100	80	70	60	50	40
Unit 2 (20%)	100	80	70	60	50	40
Unit 3 (30%)	150	120	105	90	75	60
Unit 4 (30%)	150	120	105	90	75	60

The uniform marks obtained for each unit are added up and the subject grade is based on this total.

		Qualification grade				
	Maximum uniform marks	**A**	**B**	**C**	**D**	**E**
GCE AS	200	160	140	120	100	80
GCE A level	500	400	350	300	250	200

At A level, Grade A* will be awarded to candidates who have achieved a Grade A (400 uniform marks) in the overall A level qualification and at least 90% of the total uniform marks for the A2 units (270 uniform marks).

APPENDIX A

Assessment criteria for the design and make task (Unit 2)

The assessment criteria for learners' design and make task in *engineering design; fashion and textiles* and *product design* are summarised in the table and shown in detail on the following pages.

Assessment Criteria		Marks	Assessment objective
(a)	Identifying and investigating design possibilities	12	AO 1
(b)	Developing a design brief and specification	12	
(c)	Generating and developing design ideas	20	AO 2
(d)	Manufacturing a prototype*	20	
(e)	Analysing and evaluating design decisions and prototypes	16	AO 3
	Total	80	

AO1 Identify, investigate and outline design possibilities to address needs and wants

(a) Identifying and investigating design possibilities [AO1] *The candidate has:*	**Band**
10 – 12 marks • undertaken thorough and effective identification of opportunities for the development of designs • undertaken detailed, relevant, wide-ranging research and investigation • undertaken detailed and effective analysis of information, reflecting the needs, wants and values of potential users • identified a broad range of problems/opportunities to clearly inform the development of possible design briefs	**4**
7 – 9 marks • undertaken effective identification of opportunities for the development of designs • undertaken relevant, wide-ranging research and investigation • undertaken effective analysis of information, reflecting the needs, wants and values of potential users • identified a range of problems/opportunities to inform the development of possible design briefs	**3**
4 – 6 marks • identified some opportunities for the development of designs • undertaken research and investigation • undertaken some analysis of information, though the needs, wants and values of potential users may not have not been fully considered • identified some problems/opportunities which partially inform the development of possible design briefs	**2**
1 – 3 marks • identified one opportunity for the possible development of designs • undertaken little research and investigation • undertaken a basic analysis of information, with little or no consideration of the needs, wants and values of potential users • identified few problems/opportunities and developed a design brief with little reference to their investigations	**1**
0 marks • produced no work that is worthy of a mark	

(b)	**Developing a design brief and specification** **[AO1]** *The candidate has:*	**Band**
	10 – 12 marks • fully considered a broad range of problems/opportunities before deciding upon a final design brief • demonstrated a thorough understanding of the task ahead and the requirements which have to be met, to satisfy the needs, wants and values of potential users • generated a design brief, relevant to the need/problem and clearly based upon a thorough analysis of their research and investigation • produced a detailed, relevant specification, including a broad range of objective and measurable criteria, to direct and inform the design and manufacture of a prototype	**4**
	7 – 9 marks • considered a range of problems/opportunities before deciding upon a final design brief • demonstrated a good understanding of the task ahead and most of the requirements which have to be met, to satisfy most of the needs, wants and values of potential users • generated a design brief, relevant to the need/problem, based upon a general analysis of their research and investigation • produced a relevant specification, including a range of objective and measurable criteria, to inform the design and manufacture of a prototype	**3**
	4 – 6 marks • considered some problems/opportunities before deciding on a final design brief • demonstrated a general understanding of the task ahead and one or two requirements have been identified to satisfy some of the needs, wants and values of potential users • generated a design brief, based upon some aspects of the analysis of their research and investigation • produced a specification, including the key points, to partially inform the design and manufacture of a prototype	**2**
	1 – 3 marks • focussed on a single opportunity to produce a design brief • demonstrated a limited understanding of the task ahead, with little or no consideration of the needs, wants and values of potential users • generated a design brief based upon simple analysis of their research and investigation • produced a small range of partially appropriate specification points.	**1**
	0 marks • produced no work that is worthy of a mark	

AO2 Design and make prototypes that are fit for purpose

(c) Generating and developing design ideas [AO2] *The candidate has:*	Band
16 – 20 marks • considered a range of design strategies, techniques and approaches and applied an iterative design process to generate and communicate a broad and diverse range of initial ideas • identified and thoroughly considered social, moral and ethical factors which are relevant to the need/problem and potential user(s) • made very good use of modelling and testing to evolve ideas and to support decision making • developed a detailed proposal, including comprehensive and relevant details of materials, dimensions, finishes and production techniques, which clearly addresses all requirements of the design brief and specification • demonstrated sophisticated use of a range of skills/techniques to clearly communicate ideas and proposals to a third party	**4**
11 – 15 marks • considered a range of design strategies, techniques and approaches and applied an iterative design process to generate and communicate a broad range of initial ideas • identified and considered social, moral and ethical factors which are generally relevant to the need/problem and potential user(s) • made good use of modelling and testing to evolve ideas and to support decision making • developed a proposal, including relevant details of materials, dimensions, finishes and production techniques, which addresses the main requirements of the design brief and specification • demonstrated good use of a range of skills/techniques to communicate ideas and proposals to a third party	**3**

6 – 10 marks • considered some design strategies and techniques and applied an iterative design process to generate and communicate a range of initial ideas • identified social, moral and ethical factors with some attempt to relate these to the need/problem and potential user(s) • made some use of modelling and/or testing to evolve ideas and to support decision making • developed a proposal, including some details of materials, dimensions, finishes and/or production techniques, which addresses some requirements of the design brief and specification • demonstrated satisfactory use of a small range of skills/techniques to communicate ideas and proposals to a third party	**2**
1 – 5 marks • applied an iterative design process to generate and communicate a limited range of undeveloped initial ideas • identified aspects of social, moral and ethical factors, though these are not closely related to the need/problem and or potential user(s) • made little or no use of modelling and/or testing to evolve ideas • developed a proposal, with superficial details of materials, dimensions, finishes and/or production techniques which addresses few requirements of the design brief and/or specification • demonstrated limited ability to communicate their idea(s) to a third party	**1**
0 marks • produced no work that is worthy of a mark	

(d)	**Manufacturing a prototype** [AO2] *The candidate has:*	**Band**
	16 – 20 marks • clearly communicated relevant details of a logical sequence and achievable timeline for the stages of production and testing of the final prototype • selected and worked with appropriate materials and components to successfully complete the manufacture of the prototype to a defined schedule • implemented a range of appropriate making skills and processes to produce a high quality functioning prototype that meets the requirements of the design specification and is fit for purpose • demonstrated an excellent understanding of the working properties and performance characteristics of the specified materials and, where appropriate, consideration of surface treatments/finishes, • selected and safely used a range of specialist tools, appropriate techniques, processes, equipment and machinery with a high level of accuracy and precision to enable the prototype to perform as intended and meet the needs, wants and values of the user	**4**
	11 – 15 marks • communicated details of a logical sequence and achievable timeline for the stages of production and testing of the final prototype • selected and worked with materials and components to successfully complete the manufacture the prototype, generally to a defined schedule • Implemented a range of appropriate making skills and processes to produce a good quality functioning prototype that generally meets the requirements of the design specification and is fit for purpose • demonstrated a good understanding of the working properties and performance characteristics of the specified materials and, where appropriate, consideration of surface treatments/finishes, • selected and safely used a range of specialist tools, appropriate techniques, processes, equipment and machinery with accuracy and precision to enable the prototype to perform as intended and meet the needs, wants and values of the user	**3**
	6 – 10 marks • communicated details of a sequence for manufacture and testing of the final prototype • selected and worked with materials and components to partly complete the manufacture of the prototype generally to a defined schedule • implemented an adequate range of making skills and processes to produce a functioning prototype that partially meets the requirements of the design specification and is generally fit for purpose • demonstrated an understanding of the main working properties and performance characteristics of the specified materials and, where appropriate, basic consideration of surface treatments/finishes • selected and safely used a range of specialist tools, techniques, processes, equipment and machinery with a degree of accuracy and precision, the prototype generally performs as intended and meets some aspects of the needs, wants and values of the user	**2**

1 – 5 marks • communicated superficial or no details of a sequence for manufacture and/or testing of the final prototype • worked with materials and components to partly completed the manufacture of the prototype • Implemented some making skills and processes to produce a partially functioning prototype, aspects of which meet elements of the design specification • Demonstrated a limited understanding of the working properties and/or performance characteristics of the specified materials • selected and safely used a range of specialist tools, techniques, processes, equipment and machinery with a limited degree of accuracy, the prototype partially performs as intended though meets few aspects of the needs, wants and values of the user	**1**
0 marks • produced no work that is worthy of a mark	

AO3 Analyse and evaluate

- **design decisions and outcomes, including for prototypes made by themselves and others**
- **wider issues in design and technology**

(e)	**Analysing and evaluating design decisions and prototypes [AO3]** *The candidate has:*	**Band**
	13 – 16 marks • undertaken a thorough, critical, objective analysis, evaluation and testing of their ideas and decisions whilst applying iterative design processes • undertaken a thorough, critical and objective evaluation and testing of the final prototype, taking into account the views of potential users • identified, with detailed reference to relevant qualitative and quantitative criteria, how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended users	**4**
	9 – 12 marks • undertaken an objective analysis, evaluation and testing of their ideas and decisions whilst applying iterative design processes • undertaken an objective analysis, evaluation and testing of the final prototype, with some consideration of the views of potential users • identified, with reference to aspects of qualitative and quantitative criteria, how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended user	**3**
	5 – 8 marks • undertaken some analysis, evaluation and/or testing of their ideas and decisions whilst applying iterative design processes • undertaken some analysis, evaluation and/or testing of the final prototype, with partial consideration of the views of potential users • identified how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended user	**2**
	1 – 4 marks • produced a limited evaluation of their ideas and decisions whilst applying iterative design processes • produced a limited evaluation of the final prototype • partially identified how the final prototype could be further developed or improved	**1**
	0 marks • produced no work that is worthy of a mark	

APPENDIX B

Assessment criteria for the design and make project (Unit 4)

The assessment criteria for learners' design and make project in *engineering design; fashion and textiles* and *product design* are summarised in the table and shown in detail on the following pages.

Assessment Criteria		Marks	Assessment objective
(a)	Identifying and investigating design possibilities	15	AO 1
(b)	Developing a design brief and specification	15	
(c)	Generating and developing design ideas	25	AO 2
(d)	Manufacturing a prototype	25	
(e)	Analysing and evaluating design decisions and prototypes	20	AO 3
	Total	100	

AO1 Identify, investigate and outline design possibilities to address needs and wants

(a) **Identifying and investigating design possibilities** **[AO1]** *The candidate has:*	**Band**
13 – 15 marks • considered a range of design strategies, techniques and approaches and undertaken thorough and highly effective identification of opportunities for the development of designs • undertaken comprehensive, relevant, wide-ranging research and investigation • undertaken comprehensive and highly effective analysis of information, reflecting the needs, wants and values of potential users • identified a broad range of problems/opportunities to clearly inform the development of possible design briefs • fully considered relevant approaches to project management, within the constraints of the time and resources available	**5**
10 – 12 marks • considered a range of design strategies, techniques and approaches and undertaken thorough and effective identification of opportunities for the development of designs • undertaken detailed, relevant, wide-ranging research and investigation • undertaken detailed and effective analysis of information, reflecting the needs, wants and values of potential users • identified a broad range of problems/opportunities to clearly inform the development of possible design briefs • considered relevant approaches to project management, within the constraints of the time and resources available	**4**
7 – 9 marks • considered some design strategies and techniques and undertaken effective identification of opportunities for the development of designs • undertaken relevant, wide-ranging research and investigation • undertaken effective analysis of information, reflecting the needs, wants and values of potential users • identified a range of problems/opportunities to inform the development of possible design briefs • briefly considered approaches to project management, within the constraints of the time and resources available	**3**

4 – 6 marks • considered some design strategies and identified some opportunities for the development of designs • undertaken research and investigation • undertaken some analysis of information, though the needs, wants and values of potential users may not have not been fully considered • identified some problems/opportunities which partially inform the development of possible design briefs • noted some approaches to project management.	**2**
1 – 3 marks • identified one opportunity for the possible development of designs • undertaken little research and investigation • undertaken a basic analysis of information, with little consideration of the needs, wants and values of potential users • identified few problems/opportunities and developed a design brief with basic reference to their investigations • demonstrated little or no consideration of project management	**1**
0 marks • produced no work that is worthy of a mark	

(b)	**Developing a design brief and specification** [AO1] *The candidate has:*	**Band**
	13 – 15 marks • fully considered a comprehensive range of strategies, techniques and approaches to enable them to explore, create and evaluate design ideas • fully considered a comprehensive range of problems/opportunities before deciding upon a final design brief • demonstrated a thorough and detailed understanding of the task ahead and the requirements which have to be met, to satisfy the needs, wants and values of potential users • generated a design brief, clearly based upon a comprehensive and detailed analysis of their research and investigation • produced a detailed, relevant specification, including a comprehensive range of objective and measurable criteria, and the application of relevant standards, to direct and inform the design and manufacture of a prototype	**5**
	10 – 12 marks • considered a broad range of strategies, techniques and approaches to enable them to explore, create and evaluate design ideas • fully considered a broad range of problems/opportunities before deciding upon a final design brief • demonstrated a thorough understanding of the task ahead and the requirements which have to be met, to satisfy the needs, wants and values of potential users • generated a design brief, clearly based upon a thorough analysis of their research and investigation • produced a detailed, relevant specification, including a broad range of objective and measurable criteria, and the application of relevant standards, to direct and inform the design and manufacture of a prototype	**4**
	7 – 9 marks • considered a range of strategies, techniques and approaches to enable them to explore, create and evaluate design ideas • considered a range of problems/opportunities before deciding upon a final design brief • demonstrated a good understanding of the task ahead and most of the requirements which have to be met, to satisfy most of the needs, wants and values of potential users • generated a design brief, based upon a general analysis of their research and investigation • produced a relevant specification, including a range of objective and measurable criteria, and application of relevant standards, to inform the design and manufacture of a prototype	**3**

4 – 6 marks • considered some strategies, techniques and approaches to enable them to explore, create and evaluate design ideas • considered some problems/opportunities before deciding on a final design brief • demonstrated a general understanding of the task ahead and one or two requirements have been identified to satisfy some of the needs, wants and values of potential users • generated a design brief, based upon some aspects of the analysis of their research and investigation • produced a specification, including the key points, to partially inform the design and manufacture of a prototype	**2**
1 – 3 marks • briefly considered a strategy, approach or technique with the potential to help them explore, create and evaluate design ideas • focussed on a single opportunity to produce a design brief • demonstrated a limited understanding of the task ahead, with little or no consideration of the needs, wants and values of potential users • generated a design brief based upon simple analysis of their research and investigation • produced a small range of partially appropriate specification points	**1**
0 marks • produced no work that is worthy of a mark	

AO2 Design and make prototypes that are fit for purpose

(c)	**Generating and developing design ideas** [AO2] *The candidate has:*	**Band**
	21 – 25 marks • applied an iterative design process to generate and communicate a comprehensive and diverse range of initial ideas • clearly identified and thoroughly considered environmental, sustainability, costs, social, moral and ethical factors, which are relevant to the design and potential user(s) • made excellent use of modelling and testing to evolve ideas and to support decision making • developed a detailed proposal, including comprehensive and relevant details of materials, dimensions, finishes and production techniques, which clearly addresses all requirements of the design brief and specification • fully considered the manufacture of the prototype, including planning for accuracy and efficiency and, where appropriate, making recommendations for different scales of production • demonstrated sophisticated and highly effective use of a range of skills/techniques to clearly communicate ideas and proposals to a third party	**5**
	16 – 20 marks • applied an iterative design process to generate and communicate a broad and diverse range of initial ideas • identified and thoroughly considered environmental, sustainability, costs, social, moral and ethical factors which are relevant to the design and potential user(s) • made very good use of modelling and testing to evolve ideas and to support decision making • developed a detailed proposal, including comprehensive and relevant details of materials, dimensions, finishes and production techniques, which clearly addresses all requirements of the design brief and specification • considered the manufacture of the prototype, including planning for accuracy and efficiency and, where appropriate, making recommendations for different scales of production • demonstrated sophisticated use of a range of skills/techniques to clearly communicate ideas and proposals to a third party	**4**

11 – 15 marks • applied an iterative design process to generate and communicate a broad range of initial ideas • identified and considered environmental, sustainability, costs, social, moral and ethical factors which are generally relevant to the design and potential user(s) • made good use of modelling and testing to evolve ideas and to support decision making • developed a proposal, including relevant details of materials, dimensions, finishes and production techniques, which addresses the main requirements of the design brief and specification • considered the manufacture of the prototype, including some planning for accuracy and/or efficiency and, where appropriate, making brief recommendations for different scales of production • demonstrated good use of a range of skills/techniques to communicate ideas and proposals to a third party	**3**
6 – 10 marks • applied an iterative design process to generate and communicate a range of initial ideas • identified a number of factors from environmental, sustainability, costs, social, moral and ethical, with some attempt to relate these to the design and potential user(s) • made some use of modelling and/or testing to evolve ideas and to support decision making • developed a proposal, including some details of materials, dimensions, finishes and/or production techniques, which addresses some requirements of the design brief and specification • considered the manufacture of the prototype, including some planning for accuracy and/or efficiency • demonstrated satisfactory use of a small range of skills/techniques to communicate ideas and proposals to a third party	**2**
1 – 5 marks • applied an iterative design process to generate and communicate a limited range of undeveloped initial ideas • identified a number of factors from environmental, sustainability, costs, social, moral and ethical, though these are not closely related to the design and or potential user(s) • made little use of modelling and/or testing to evolve ideas • developed a proposal, with superficial details of materials, dimensions, finishes and/or production techniques which addresses few requirements of the design brief and/or specification • demonstrated limited ability to communicate their idea(s) to a third party	**1**
0 marks • produced no work that is worthy of a mark	

(d)	**Manufacturing a prototype** [AO2] *The candidate has:*	**Band**
	21 – 25 marks • clearly and comprehensively communicated relevant details of a logical sequence and achievable timeline for the stages of production and testing of the final prototype • selected and worked with appropriate materials and components to successfully complete the manufacture of the prototype to a defined schedule • implemented a range of appropriate making skills and processes to produce a very high quality fully-functioning prototype that meets the requirements of the design specification and is fit for purpose • demonstrated an excellent understanding of the working properties and performance characteristics of the specified materials and, where appropriate, detailed consideration of surface treatments/finishes for functional and aesthetic purposes • selected and safely used a range of specialist tools, appropriate techniques, processes, equipment and machinery with considerable accuracy and precision to enable the prototype to perform as intended and meet the needs, wants and values of the user	**5**
	16 – 20 marks • clearly communicated relevant details of a logical sequence and achievable timeline for the stages of production and testing of the final prototype • selected and worked with appropriate materials and components to successfully complete the manufacture of the prototype to a defined schedule • implemented a range of appropriate making skills and processes to produce a high quality functioning prototype that meets the requirements of the design specification and is fit for purpose • demonstrated very good understanding of the working properties and performance characteristics of the specified materials and, where appropriate, consideration of surface treatments/finishes for functional and aesthetic purposes • selected and safely used a range of specialist tools, appropriate techniques, processes, equipment and machinery with a high level of accuracy and precision to enable the prototype to perform as intended and meet the needs, wants and values of the user	**4**

11 – 15 marks • communicated details of a logical sequence and achievable timeline for the stages of production and testing of the final prototype • selected and worked with appropriate materials and components to successfully complete the manufacture the prototype, generally to a defined schedule • implemented a range of appropriate making skills and processes to produce a good quality functioning prototype that generally meets the requirements of the design specification and is fit for purpose • demonstrated a good understanding of the working properties and performance characteristics of the specified materials and, where appropriate, consideration of surface treatments/finishes • selected and safely used a range of specialist tools, appropriate techniques, processes, equipment and machinery with accuracy and precision to enable the prototype to perform as intended and meet the needs, wants and values of the user	**3**
6 – 10 marks • communicated details of a sequence for manufacture and testing of the final prototype • selected and worked with materials and components to partly complete the manufacture of the prototype generally to a defined schedule • implemented an adequate range of making skills and processes to produce a functioning prototype that partially meets the requirements of the design specification and is generally fit for purpose • demonstrated an understanding of the main working properties and performance characteristics of the specified materials, and, where appropriate, basic consideration of surface treatments/finishes • selected and safely used a range of specialist tools, techniques, processes, equipment and machinery with a degree of accuracy and precision, the prototype generally performs as intended and meets some aspects of the needs, wants and values of the user	**2**
1 – 5 marks • communicated superficial or no details of a sequence for manufacture and/or testing of the final prototype • worked with materials and components to partly complete the manufacture of the prototype • Implemented some making skills and processes to produce a partially functioning prototype, aspects of which meet elements of the design specification • Demonstrated a limited understanding of the working properties and/or performance characteristics of the specified materials • selected and safely used a range of specialist tools, techniques, processes, equipment and machinery with a limited degree of accuracy, the prototype partially performs as intended though meets few aspects of the needs, wants and values of the user	**1**
0 marks • produced no work that is worthy of a mark	

AO3 Analyse and evaluate

- **design decisions and outcomes, including for prototypes made by themselves and others**
- **wider issues in design and technology**

(e)	**Analysing and evaluating design decisions and prototypes [AO3]** *The candidate has:*	**Band**
	17 – 20 marks • undertaken thorough and detailed, critical, objective analysis, evaluation and testing of their ideas and decisions whilst applying iterative design processes • undertaken a thorough and detailed, critical and objective evaluation and testing of the final prototype, taking into account the views of potential users • identified, with comprehensive and detailed reference to relevant qualitative and quantitative criteria, how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended users throughout the product life cycle	**5**
	13 – 16 marks • undertaken thorough, critical, objective analysis, evaluation and testing of their ideas and decisions whilst applying iterative design processes • undertaken thorough, critical and objective evaluation and testing of the final prototype, taking into account the views of potential users • identified, with detailed reference to relevant qualitative and quantitative criteria, how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended users throughout the product life cycle	**4**
	9 – 12 marks • undertaken an objective analysis, evaluation and testing of their ideas and decisions whilst applying iterative design processes • undertaken an objective analysis, evaluation and testing of the final prototype, with some consideration of the views of potential users • identified, with reference to aspects of qualitative and quantitative criteria, how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended user	**3**

5 – 8 marks • undertaken some analysis, evaluation and/or testing of their ideas and decisions whilst applying iterative design processes • undertaken some analysis, evaluation and/or testing of the final prototype, with partial consideration of the views of potential users • identified how their design decisions and the final prototype could be further developed or improved to better meet the needs, wants and values of the intended user	**2**
1 – 4 marks • produced a limited evaluation of their ideas and decisions whilst applying iterative design processes • produced a limited evaluation of the final prototype • partially identified how the final prototype could be further developed or improved	**1**
0 marks • produced no work that is worthy of a mark	