

APPROVAL CRITERIA FOR GCE AS AND A LEVEL DESIGN AND TECHNOLOGY



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This is a **Regulatory Document** under **Condition B7** of the Interim Standard Conditions of Recognition¹: Compliance with Regulatory Documents.

¹ <http://qualificationswales.org/regulation/monitoring-awarding-bodies/?lang=en>

Introduction

This document sets out the approval criteria for AS and A Level Design and Technology qualifications. These have been developed through stakeholder engagement and public consultation. They include the requirements that an awarding body must meet when developing the specification and assessment materials for the qualification.

The approval criteria in this document will come into effect from 18 July 2016.

Qualifications Wales will only approve qualifications that meet all of the requirements set out in this document together with those set out in the GCE AS and A Level Qualification Approval Criteria² and Interim Standard Conditions of Recognition³. In developing qualifications to meet these requirements awarding bodies must have regard to Fair Access by Design⁴.

Where the requirements of the Subject Approval Criteria set out in this document differ from those prescribed in the GCE AS and A Level Qualifications Approval Criteria and the Interim Standard Conditions of Recognition, the requirements in this document will take precedence.

² <http://qualificationswales.org/regulation/approved-and-designated-qualifications/as-a-level-approval-criteria-july-2016/?lang=en>

³ <http://qualificationswales.org/regulation/monitoring-awarding-bodies/?lang=en>

⁴ <http://gov.wales/docs/dcells/publications/150727-fair-access-by-design-en.pdf>

Subject aims and objectives

1. AS and A Level Design and Technology specifications should encourage learners to use creativity and imagination when applying iterative design processes to develop and modify designs, and to design and make prototypes⁵ that solve real world problems, considering their own and others' needs, wants, aspirations and values.
2. AS and A Level Design and Technology specifications should enable learners to identify market needs and opportunities for new products, initiate and develop design solutions, and make and test prototypes⁵. Learners should acquire subject knowledge in design and technology, including how a product can be developed through the stages of prototyping⁵, realisation and commercial manufacture.
3. AS and A Level Design and Technology 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 AS and A Level Design and Technology.
4. AS and A Level Design and Technology must enable learners to:
 - 4.1. 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;
 - 4.2. work collaboratively to develop and refine their ideas, responding to feedback from users, peers and expert practitioners;
 - 4.3. gain an insight into the creative, engineering and/or manufacturing industries;
 - 4.4. 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;
 - 4.5. develop knowledge and experience of real world contexts for design and technological activity;

⁵ In this document 'prototype' is used to describe all working solutions including products, models and systems.

- 4.6. 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;
- 4.7. be able to make informed design decisions through an in-depth understanding of the management and development of taking a design through to a prototype⁶/product;
- 4.8. 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;
- 4.9. be able to work safely and skilfully to produce high-quality prototypes⁶;
- 4.10. have a critical understanding of the wider influences on design and technology, including cultural, economic, environmental, historical and social factors;
- 4.11. 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.

Subject content

5. AS and A Level specifications in Design and Technology must specify that learners engage in both practical and theoretical study in design and technology. Specifications must require learners to cover the design and technology skills, knowledge and understanding as set out below.
6. The AS and A Level Design and Technology specification must contain the following three focus areas and allow learners to specialise in one of these areas:
 - 6.1. Design and Technology (Engineering Design)
 - 6.2. Design and Technology (Fashion and Textiles)
 - 6.3. Design and Technology (Product Design)

Core technical principles

7. AS and A Level specifications must require learners to demonstrate the appropriate mathematical and scientific knowledge, understanding and skills;
8. AS and A Level specifications must require learners to develop knowledge and understanding of:

⁶ In this document 'prototype' is used to describe all working solutions including products, models and systems.

- 8.1. 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;
 - 8.2. the requirements for product design, development and manufacture, including:
fitness for purpose; meeting the criteria of specifications; accuracy of production;
 - 8.3. 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;
 - 8.4. digital design and digital manufacture, including computer-aided design (CAD)/computer-aided manufacturing (CAM), modelling and simulation;
 - 8.5. safe working practices, including identifying hazards and understanding the need for risk assessments;
 - 8.6. how skills and knowledge from other subject areas, including mathematics and science, inform decisions in design and the application or development of technology.
9. In addition, at A2, learners are required to develop knowledge and understanding of:
- 9.1. 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;
 - 9.2. the regulatory and legislative framework for health and safety and the impact on designing and making;
 - 9.3. the use of feasibility studies on the practicability of proposed solutions to problems;
 - 9.4. design for manufacturing, repair or maintenance, and product life;
 - 9.5. 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;
 - 9.6. the implications of intellectual property, registered designs, registered trademarks, copyright, design rights and patents;

- 9.7. the role of marketing, enterprise, innovation and collaboration in the development of products.

Core designing and making principles

10. All AS and A Level specifications in Design and Technology must require learners to develop knowledge and understanding of:

- 10.1. 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;
- 10.2. design theory, including key historic movements/figures and their methods;
- 10.3. the application of knowledge and understanding in a product development process to design, make and evaluate prototypes⁷/products;
- 10.4. 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;
- 10.5. how to critically analyse and evaluate their own ideas and decisions whilst using iterative design and make processes;
- 10.6. 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;
- 10.7. how to measure, determine, and apply the degree of accuracy and precision required for products to perform as intended;
- 10.8. how to evaluate their prototypes⁷/products taking into account the views of potential users, customers or clients.

11. In addition, at A2, learners are required to develop knowledge and understanding of:

- 11.1. a range of strategies, techniques and approaches to explore, create and evaluate design ideas, such as user-centred design, circular economy, and systems thinking;

⁷ In this document 'prototype' is used to describe all working solutions including products, models and systems.

- 11.2. approaches to project management, such as critical path analysis, scrum or six sigma;
- 11.3. design for manufacture, including planning for accuracy and efficiency when making prototypes⁸ and making recommendations for small, medium and large scale production;
- 11.4. the environmental factors affecting disposal of waste, surplus materials, components and by-products, sustainability, and costs;
- 11.5. 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;
- 11.6. the stages of a product life cycle.

Engineering Design

12. All AS and A Level Design and Technology (Engineering Design) specifications must require learners to have knowledge and understanding of:
 - 12.1. system design processes and methods;
 - 12.2. the use of 'blue sky' and incremental innovation, and of new/emerging technologies;
 - 12.3. visualisation and simulation including the application of computer aided design (CAD) and computer aided engineering (CAE) software;
 - 12.4. the characteristics and working properties of materials relevant to engineering including smart and modern materials;
 - 12.5. the principles of electronics including sensing, control, and output systems;
 - 12.6. static and dynamic forces in structures, including the forces of: tension, compression, torsion and bending; stress, strain and elasticity; rigidity and modes of failure;
 - 12.7. mechanical systems;
 - 12.8. energy sources, energy storage, transmission, and utilisation;
 - 12.9. programmable and control devices including how to use such devices to solve problems in system design;
 - 12.10. how to represent systems and components through the use of circuit diagrams, flowcharts and constructional diagrams;
 - 12.11. how to develop and use production plans.

⁸ *In this document 'prototype' is used to describe all working solutions including products, models and systems.*

13. In addition, at A2, learners are required to have a knowledge and understanding of:

- 13.1. industrial and commercial practice including manufacturing processes and systems, the use of ICT, prototyping⁹, product manufacture and maintenance, production scales, and quality control in relation to the engineering industries;
- 13.2. how to interface electrical/electronic circuits with mechanical and pneumatic systems and components;
- 13.3. communication protocols, including an understanding of interfacing with wireless devices, embedded devices, and smart objects;
- 13.4. product lifecycle management, engineered lifespans including planned obsolescence, the need for maintenance of machinery, product support, and end of life (EOL);
- 13.5. how testing, including the use of destructive and non-destructive methods, is used to inform and modify designs;
- 13.6. the prediction of performance through modelling, including the use of IT based tools.

Fashion and Textiles

14. All AS and A Level Design and Technology (Fashion and Textiles) specifications must require learners to have knowledge and understanding of:

- 14.1. the characteristics and working properties of materials relevant to fashion and textiles design, development, and manufacture, including:
- 14.2. the sources and classification of the main fibre groups, fabrics and yarns;
- 14.3. the production processes associated with mixtures and blends;
- 14.4. laminating as a finishing process;
- 14.5. methods of joining fabrics including the use of fastenings;
- 14.6. the working properties and physical characteristics of fibres and fabrics in relation to their suitability for various products;
- 14.7. the performance characteristics of fibres and fabrics including tensile strength, elasticity, resilience, durability, flammability, and weight;

⁹ In this document 'prototype' is used to describe all working solutions including products, models and systems.

- 14.8. the qualities given to fabrics by the construction methods used, finishes and surface decoration, and through surface pattern technologies;
 - 14.9. the applications of smart materials, e-textiles, and technical textiles;
 - 14.10. how materials, other than fibres and fabrics, can be used in textiles and fashion design and development;
 - 14.11. a variety of components and their appropriateness for a range of products in relation to the end-user, fabrics used, and design considerations.
15. In addition, at A2, learners are required to have a knowledge and understanding of:
- 15.1. industrial and commercial practice including manufacturing processes, the use of 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;
 - 15.2. the use of pattern drafting and toiles.

Product Design

16. All AS and A Level Design and Technology (Product Design) specifications must require learners to have knowledge and understanding of:
- 16.1. the characteristics and working properties of materials relevant to product design and manufacture, including: metals, woods, polymers, textiles, composites, smart and modern materials;
 - 16.2. the use of adhesives, permanent, and semi-permanent fixings;
 - 16.3. 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;
 - 16.4. the performance characteristics of woods, metals, and polymers including toughness, hardness, elasticity and durability in relation to specific product applications;
 - 16.5. the application of smart and modern materials;
 - 16.6. production processes including moulding, extrusion, laminating, milling, turning, casting, stamping, and forming; the use of ICT, prototyping¹⁰, jigs and fixtures.

¹⁰ In this document 'prototype' is used to describe all working solutions including products, models and systems.

17. In addition, at A2, learners are required to have a knowledge and understanding of:

17.1. 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;

17.2. modular/cell production systems, just-in-time manufacturing, bought-in parts and components and the use of standardised parts;

17.3. rapid prototyping¹¹.

Assessment objectives

18. The assessment of the knowledge, understanding, and skills required in the AS and A Level Design and Technology specifications must target the following assessment objectives in line with the indicated weightings:

Objective	Requirements	Weightings		
		AS	A2	A Level
AO1	Identify, investigate and outline design possibilities to address needs and wants;	10-15%	10-15%	10-15%
AO2	Design and make prototypes ¹¹ that are fit for purpose;	20-25%	20-25%	20-25%
AO3	Analyse and evaluate – <ul style="list-style-type: none"> • design decisions and outcomes, including for prototypes¹¹ made by themselves and others • wider issues in design technology; 	20-25%	20-25%	20-25%
AO4	Demonstrate and apply knowledge and understanding of – <ul style="list-style-type: none"> • technical principles • design and making principles. 	35-40%	35-40%	35-40%

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Scheme of assessment

19. AS and A Level Design and Technology specifications must include non-examination assessment which:

- 19.1. will be assessed through a portfolio of evidence and a prototype¹² produced by the candidate;
- 19.2. contributes to 50 percent of the qualification assessment weighting;
- 19.3. will include marks allocated from AO1, AO2 and AO3.

Titling

20. The qualification title presented on the award certification must meet the requirements as outlined in the Interim Standards of Recognition (Conditions E2 and I3.2).

21. The qualification title presented on the award certificate must have the endorsement which reflects the focus area studied:

- 21.1. Engineering Design
- 21.2. Fashion and Textiles
- 21.3. Product Design

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**Further
information**

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