

## GCE Design and Technology: Product Design

OCR Advanced Subsidiary GCE in Design and Technology: Product Design H053

OCR Advanced GCE in Design and Technology: Product Design H453

Including:  
Built Environment and Construction  
Engineering  
Food  
Graphic Products  
Manufacturing  
Resistant Materials  
Systems and Control  
Textiles

version 5 – September 2013  
**specification**

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Vertical black lines indicate a significant change to the previous printed version.

# 1 About these Qualifications

This booklet contains OCR's Advanced Subsidiary GCE and Advanced GCE specifications in Design and Technology: Product Design for teaching from September 2013.

These Design and Technology specifications are designed to offer candidates the opportunity to study, propose and realise prototype solutions closely linked to the real world of product manufacture in a range of material areas. Recognising the routes that are pursued at GCSE, these specifications provide candidates the opportunity to continue their studies either exclusively or as a combination of focus material areas.

These specifications are designed to encourage candidates to:

- initiate design solutions, develop, test and trial working models and prototypes;
- develop and sustain imagination, innovation and flair when working with concepts and materials;
- develop an understanding of contemporary design and technological practices and consider the uses and effects of new technologies and modern materials;
- develop thinking skills, financial capability, enterprise and entrepreneurial skills.

## 1.1 The Two-Unit AS

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The Advanced Subsidiary (AS) GCE is both a 'stand-alone' qualification and also the first half of the corresponding Advanced GCE. The AS GCE is assessed at a standard appropriate for candidates who have completed the first year of study (both in terms of teaching time and content) of the corresponding two-year Advanced GCE course, ie between GCSE and Advanced GCE.

From September 2013 the AS GCE is made up of **two** mandatory units, which form 50% of the corresponding four-unit Advanced GCE.

*F521: Advanced Innovation Challenge.* Candidates take part in a timed design challenge based on a pre-released theme, under examination conditions. The challenge consists of a design, and modelling exercise recorded in a workbook. A written reflection paper is completed at a later date. The challenge and reflection paper are held in the centre and are marked externally by OCR.

*F522: The Product Study.* Candidates should carry out an in-depth product analysis resulting in suggestions for improvements. This is a coursework component that is marked by the teacher, internally standardised within the centre and externally moderated by OCR.

## 1.2 The Four-Unit Advanced GCE

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From September 2013 the Advanced GCE is made up of **two** mandatory units at AS and **two** further mandatory units at A2.

In F523: *Design, Make and Evaluate*, candidates are required to produce a portfolio and product. The project is marked by the teacher, internally standardised within the centre and externally moderated by OCR.

F524: *Product Design* is a written paper that consists of two components. Candidates are able to select questions across the focus material areas if they wish.

## 1.3 Qualification Titles and Levels

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These qualifications are shown on a certificate as:

- OCR Advanced Subsidiary GCE in Design and Technology: Product Design.
- OCR Advanced GCE in Design and Technology: Product Design.

Both qualifications are Level 3 in the National Qualification Framework (NQF).

## 1.4 Aims

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AS and A Level specifications in design and technology should encourage candidates to:

- make use of tacit knowledge and reflective practices in order to work on tasks that are challenging and often require definition;
- develop and sustain their creativity and innovative practice;
- recognise and overcome challenges and constraints when working towards the production of high-quality products;
- develop a critical understanding of the influences of the processes and products of design and technological activities from a contemporary and historical perspective;
- draw on a range of skills and knowledge from other subject areas;
- draw on and apply knowledge, understanding and skills of production processes to a range of design and technology activities;
- develop an understanding of contemporary design and technology practices;
- use information and communications technology (ICT) and information handling skills to enhance their design and technological capability;
- recognise the values inherent in design and technological activities, and develop critical evaluation skills in technical, aesthetic, ethical, economic, environmental, sustainable, social, cultural and entrepreneurial contexts.

## 1.5 Prior Learning/Attainment

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These specifications build on, but do not depend on, the knowledge, understanding and skills of KS3 and KS4 Design Technology. It is recommended that candidates have attained communication and literacy skills at a level equivalent to GCSE Grade C in English.

## 2 Summary of Content

### 2.1 AS Units

#### F521: *Advanced Innovation Challenge*

- The Advanced Innovation challenge is a design challenge assessing candidates' ability to design and model a product and then reflect on their design concept. Marks will be awarded for innovation and originality.

#### F522: *Product Study*

- The Product Study is a coursework unit. It consists of product analysis and product development, prototype modelling and testing.
- It is **not** envisaged that this task will involve the complete redesign of an existing product, but rather identify opportunities for its further development or enhancement.

### 2.2 A2 Units

#### F523: *Design, Make and Evaluate*

- Candidates are required to produce a coursework portfolio and product that fully demonstrates their designing, making and evaluation skills using creativity, flair and innovation and that can be assessed against the assessment criteria. The coursework consists of designing, making, and evaluating a product, a marketing presentation, and a review and reflection. This unit is intended to draw upon and develop skills learnt in other units.

#### F524: *Product Design*

- This is a written paper that consists of **two** components. Candidates will be able to select questions across the focus material areas.
- **Component One** consists of eight questions, and each question follows a common format. Marking: 24 of the 36 marks are drawn from the core content and relate to the material focus; 12 marks are allocated to the specific material content from each of the focus areas. Candidates answer one question.
- **Component Two** assesses the abilities of candidates to make immediate design thinking responses to a given situation. It is intended to be a discriminator in identifying those candidates who can effectively use their experiences and knowledge in designing and making.

## 3 Unit Content

### 3.1 AS F521: *Advanced Innovation Challenge*

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#### Advanced Innovation Challenge

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F521 is a seven-hour design challenge set by OCR. It is undertaken in two three-hour sessions over the period of one day and a one-hour session at a later date. All sessions are completed on dates set by OCR. The task assesses the candidates' ability to be innovative, demonstrate flair, work with materials and apply knowledge gained throughout their AS course.

A theme is released in the September prior to the examination. Each theme runs for a year, enabling candidates to research and gather resources to form a personal handling collection/inspiration box/mood board, etc. Candidates should identify and collect these resources themselves, into a collection called a job bag, which is then taken into sessions 1 and 2. A challenge sheet based on the theme will be included with the workbook and will first be seen in session 1. Candidates select one challenge from the sheet, related to the material area of their choice. There are several challenges dealing with all material areas covered by these specifications.

The advanced challenge requires candidates to work with materials in either a supervised examination room, a design workshop or a suitable room identified by the centre as appropriate, which meets the requirements of the JCQ Instructions for conducting examinations. In session 1, with their job bag as inspiration, candidates produce a specification and design brief using annotated sketches, notes and models to describe their ideas and designs. They choose one design to take forward into session 2. In session 2, candidates model their chosen design, record their thoughts and further ideas in their workbook and evaluate their final design and model against the original specification. In session 3, candidates have the chance to reflect on the product designed in sessions 1 and 2 in a written examination.

There is a teacher script that guides the activities through sessions 1 and 2. Centres preparing for the challenge must consider in detail the teacher script and use this and the theme to establish the nature of the handling collection and materials and facilities necessary to support the work activity.

This unit requires approximately 75 hours of work, of which 67 hours should be allocated to the teaching and learning of appropriate skills and 7 hours to completing the assessment task.

The Advanced Innovation Challenge is marked out of 80.

#### The Design Challenge

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Sessions 1 and 2, which are two three-hour sessions in one day, take place at a date and time set by the Board. Ideally candidates sit in groups of two or three during these sessions.

Session 3 is the written question paper. This session will take place at a later date during the same examination series.



## Session1

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Throughout the challenge, candidates are asked to record and communicate their thinking on a pre-printed answer booklet supplied by OCR. Candidates respond to the prompts in pre-numbered boxes and are guided by a member of staff who has a script to help with the organisation and timing of the sessions.

Midway through session 1, candidates have the opportunity to present their ideas to a group of two or three other candidates. Candidates are encouraged to take advice from others through this controlled and structured peer evaluation.

## Session 2

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Candidates model their most creative and exciting ideas using a range of easy-to-handle materials. Depending on the activity, they can choose from paper, card, thin plastics, fabric, wire, foil, thin metal sheet, clay, polymorph, foam board, food ingredients, electrical components, cogs/gears and joining devices. Marks are awarded for the design concept and the way in which the candidate makes resourceful use of materials and construction techniques.

Three digital photographs must be taken at specified times by a member of staff to record individual progress. These must be processed and attached to each candidate's answer booklet during the challenge.

Although prototype models are not required to be sent to the examiner with the candidate answer booklets, they should be retained as they may be required for monitoring purposes. Any supplementary photographic evidence of modelling should be placed in the workbook.

## Session 3

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Session 3 is a one-hour examination paper sat at a time and date set by the Board.

In session 3 candidates have the opportunity to reflect on the challenge by answering questions that require them to consider their product. These will be derived from a design, manufacturing or marketing perspective, including:

- sustainability and the environment;
- product life;
- social, moral and cultural issues;
- environmental issues;
- inclusive design;
- the human interface;
- aesthetics;
- scale of production;
- production technologies;
- fashion;
- marketing;
- commercial issues.

The evidence contained in the candidate answer booklets and reflection question paper is externally marked by OCR.

Below is a summary of the activities in the workbook.

<b>Advanced Innovation Challenge summary of activities and times – Session 1</b>		
<b>Reference to OCR workbook Box no.</b>	<b>Activity</b>	<b>Suggested time allocation (minutes)</b>
	Member of staff gives introduction to the challenge	5
	Context The use of the job bag	5
1	Explore the situation	5
2	Initial thoughts	5
3 & 4	Decision time Your design brief Key points	10
5	Your design specification	10
6	Start designing Product ideas	40
7	What do you think of your ideas so far?	10
8	What is your best idea?	5
Break (15 minutes approx)		
	Member of staff gives introduction to presentations	2
9	Reflect and record Group presentation planning	10
	Presentations	10 (3 mins presentation per candidate)
10	Feedback Record suggestions made by others	10
11	Improvements and modifications	40
	Introduction to modelling materials	
12	Your model	10
13	Action plan for session 2	10

<b>Advanced Innovation Challenge summary of activities and times – Session 2</b>		
<b>Reference to OCR workbook Box no.</b>	<b>Activity</b>	<b>Suggested time allocation (minutes)</b>
14	Review	10
15	Modelling	40
	Progress report 1 (photo)	10
16	Continue modelling	30
	Progress report 2 (photo)	10
Break (15 minutes approx)		
17	Plan for last 60 minutes	10
	Final modelling session	50
18	Evaluation (photo)	10
19	Evaluation against specification	10
<b>FINISH</b>		

Session 3 is the written question paper.

## 3.2 AS F522: *Product Study*

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The product study consists of product analysis and product development, prototype modelling and testing.

It is not envisaged that this task will involve the complete redesign of an existing product, but rather identify opportunities for its further development or enhancement. This unit requires approximately 75 hours of work: 45 hours should be allocated to the teaching and learning of appropriate skills, and the final project submitted for assessment should represent 30 hours work. OCR recommends a maximum of 20 A3 sheets for completing the unit. Work can be submitted in electronic format on individual candidate CD-ROMs to the OCR approved standard.

There are guidelines for the completion of coursework. Centres are reminded that parents, carers and teachers can advise candidates on the content of coursework within firm parameters. These parameters are available on the QCA website.

### Product focus and analysis

Candidates should be able to:

- select a specific single product, which has a focus within their area of expertise, and is suited to analysis and development within a prescribed timescale;
- examine and give the intended purpose of the selected single product, including the needs of both the manufacturer and consumer; identify the original key criteria against which the selected product was developed.

### Strengths and weaknesses comparison

Candidates should be able to:

- analyse the strengths and weaknesses of the single selected product;
- compare the product to other similar products in terms of function, suitability of materials, components or ingredients and manufacturing processes used, ergonomic suitability, aesthetics and cost.

### Moral implications

Candidates should be able to:

- identify and analyse the relevant moral implications associated with environmental, social and economic issues in the design and use of a product.

### Brief and specification for improving the product

Candidates should be able to:

- write a detailed brief for improving the selected product;
  - develop and justify an objective design specification.
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### Development of improvement

Candidates should be able to:

- use annotated sketching, real-time digital images and interactive dialogue to generate and record a wide range of initial ideas, to explore possible improvements;
- photograph, record and comment as improvement actually takes place;
- make sufficient appropriate prototype models to establish the validity of the proposed idea in terms of:
  - physical requirements, eg construction, movement, stability, composition, strength;
  - aesthetic qualities and/or taste as appropriate;
  - suitable manufacturing processes;
  - suitability of materials, components or ingredients;
- test and evaluate developed ideas against the specification in real time and justify the choice of one idea worthy of being taken forward.

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*This information should be presented in an integrated form and recorded in real time.*

### Testing of final developed idea

Candidates should be able to:

- use an appropriate method or system to test formally and evaluate their final developed idea, or the suitability of the proposed materials, components or ingredients;
- present results in real time, clearly and concisely.

### Summary of results

Candidates should be able to:

- produce a summary of the results of the development and prototype modelling, which includes analysis of information gained from the prototypes and details and analysis of the results gained from the testing;
- provide suggestions for further improvement to the proposed idea.

### Communication

Candidates should be able to:

- use a combination of text, graphical techniques, digital technology and interactive dialogue as appropriate to present information.
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### 3.3 A2 F523: *Design, Make and Evaluate*

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Candidates are required to produce a coursework portfolio and product that fully demonstrates their designing, making and evaluation skills, using creativity, flair and innovation, which can be assessed against the Assessment Criteria (see Appendix D). The coursework consists of designing, making and evaluating a product, a marketing presentation and review and reflection. This unit is intended to draw upon and develop skills learnt in other units.

The project is marked by the teacher, internally standardised within the centre and externally moderated by OCR.

This unit requires approximately 75 hours work: 35 hours should be allocated to the teaching and learning of a range of appropriate designing, making and evaluation skills in a variety of materials, components and ingredients. The final project submitted for assessment should represent approximately 40 hours work.

OCR recommends a maximum of 25 A3 sheets for completing the unit work can be submitted in electronic format on individual candidate CD-ROMs to the OCR approved standard.

There are guidelines for the completion of coursework. Centres are reminded that parents, carers and teachers can advise candidates on the content of coursework within firm parameters. These parameters are available on the QCA website.

#### Choice of project

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The project should enable and encourage candidates to:

- consider materials, components or ingredients and their uses;
- consider and use industrial, business and commercial practices;
- use industrial links to aid research and development;
- use industrial terminology, methods and procedures, eg 'Total Quality Management', quality control, tolerances, design teams;
- consider needs and opportunities beyond their own domestic experience;
- focus on the needs of client, manufacturer, retailer, target market and potential users;
- focus on the stated design brief and avoid any generic work that does not directly relate to the specific project;
- integrate throughout the project a consideration of production in quantity;
- utilise digital technology to enhance design and technology capability;

- use CAD/CAM and other digital applications related to the specific type of product or area of study;
- work creatively, innovatively, safely, and skilfully to produce high quality products and outcomes;
- experiment with techniques in order to improve and refine intended methods of realising a design;
- demonstrate a detailed knowledge of the working properties and functions of materials and components/ingredients;
- demonstrate care, precision, and attention to detail in the use of equipment and materials;
- consider product identity and branding;
- show a perceptive awareness of the implications of design and technology activities and their wider effects on society and environment;
- communicate concisely, clearly and unambiguously;
- collaborate with others to achieve best outcomes;
- use initiative and take responsibility for their own project management;
- take risks and respond positively to challenges.

The project should be of an appropriate level to allow in-depth study within the time allocated, and be set within the context of an area of study familiar to candidates, selected from:

- built environment and construction;
- engineering;
- food;
- graphic products;
- manufacturing;
- resistant materials;
- systems and control;
- textiles.

Care must be taken to ensure the correct choice of project. Teacher guidance is crucial, and the following key questions should be considered.

- Will the project suit the interests, ability and potential of the candidate?
- Will the project be of an appropriate level of demand, challenge and complexity, and be an appropriate making opportunity at Advanced level?
- Will the project cover a sufficient range and depth of designing and making activities to enable the candidate to demonstrate his/her ability and access the full mark range in each of the assessment criteria?
- Will the project enable the candidate to mirror industrial and commercial processes?
- Will the project encourage the candidate to look beyond their personal needs to the needs of a specific client or user group?
- Will the project give the candidate opportunities for creativity, flair and innovation?
- Will the project be manageable and realistic bearing in mind the time, resources and facilities, staff expertise and specialist support available?
- Will the candidate be able to complete the project, including the designing, making, and testing of a quality product, in the time available?

Projects may arise from the candidate's own family or contacts, hobbies and interests, part-time work, work experience, or from visits to business or industry.

The overall complexity, the breadth and/or depth of designing and making skills, and the level of thinking involved is important, rather than the size of the product.

Where centres give a theme to a teaching group, or where a number of candidates work together in a group, the following must be observed:

- each candidate must identify a design need or opportunity and present a design brief that is individual to him/herself, or must take responsibility for a uniquely definable aspect of an overall product;
- each candidate must provide unique evidence for assessment against each of the assessment criteria;
- additional evidence must be provided to indicate the performance of the individual candidate's design within the context of the performance of the overall project;
- the work of each candidate must constitute a complete project in its own right, and comply with the requirements of the specification;
- the work of each individual candidate must be presented separately for assessment, with reference to an overall product where applicable.



### Design brief

Candidates should be able to:

- present a design brief for a marketable product.

### Information, inspiration and influences

Candidates should be able to:

- obtain information relevant to the design of the product;
- present a range of evidence to show the sources of inspiration and influences on the design.

### Design specification

Candidates should be able to:

- produce a design specification for the product;
- justify the design requirements.

### Design, design development and making

Design, design development and making

Candidates should be able to:

- demonstrate competence in the design, design development and making of the product. The package of evidence to include the following five strands:
  1. the generation and exploration of design possibilities;
  2. the use of digital technologies;
  3. experimenting and modelling;
  4. the refining and defining of a final design through ongoing evaluation;
  5. the planning and making of the product.

Innovation

Candidates should be able to:

- show creativity, flair and innovation.

### Testing and independent evaluation of the final product

Candidates should be able to:

- show evidence of the testing of the product against the specification;
- identify and state strengths and weaknesses in the product;
- respond to independent evaluation.

### Marketing presentation

Candidates should be able to:

- use appropriate techniques to create a marketing presentation suitable for the final product.

### Review and reflection

Candidates should be able to:

- review and reflect on the effectiveness of the designing and making process that led to the final product;
- consider the possible wider implications and impact of the product, including possible future developments.

## 3.4 A2 F524: *Product Design*

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### Component One

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The subject content of this unit is focused towards products and applications and their analysis in respect of:

- materials, components and their uses;
- manufacturing processes;
- industrial and commercial practices.

It is essential that materials and components are studied from the perspective of analysing modern consumer products that are designed to meet identified consumer needs, their design and manufacture, and taught within the context of product development and industrial and commercial practices.

Candidates should be familiar with a range of materials, components or ingredients as used in the manufacture of commonly available products, and be able to make critical comparisons between them.

The aim of the unit is not to overburden candidates with large amounts of factual information, but rather to give them a framework for analysing existing products that enables them to make considered selections of appropriate materials and manufacturing processes when designing for making.

The unit builds upon the work undertaken at GCSE in Design and Technology and brings together the knowledge, understanding and skills acquired in the study of F521 and F522.

The knowledge and understanding gained by candidates should also directly contribute to work undertaken in F523.

### Question Paper

The question paper consists of **eight** questions. Each question follows a common format: 24 of the 36 marks are drawn from the core content and relate to the material focus, and 12 marks are allocated to the specific material content from each of the eight focus areas:

- built environment and construction;
- engineering;
- food;
- graphic products;
- manufacturing;

- resistant materials;
- textiles;
- systems and control.

These questions will test a candidate's understanding of:

- manufacturing systems;
- the use of digital technology;
- commercial practice;
- legislation;
- health and safety;
- the impact of design and manufacture on the environment;
- value issues;
- aesthetics;
- ergonomics and anthropometrics;
- testing;
- quality control and quality assurance.

## Core

Manufacturing systems	<p>Candidates should be able to demonstrate a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• one-off, batch, high volume production systems;</li> <li>• modular/cell production systems;</li> <li>• just-in-time manufacture;</li> <li>• bought-in parts and components, standardised parts;</li> <li>• the implications of these industrial production processes/procedures.</li> </ul>
The use of digital technology in designing and manufacturing processes	<p>Candidates should be able to demonstrate a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• CAD/CAM as used in industry/commerce;</li> <li>• testing, modelling and rapid prototyping;</li> <li>• stock control, monitoring, purchasing logistics in industry;</li> <li>• high volume production and automation;</li> <li>• the implications of the use of digital technology.</li> </ul>
Commercial practice	<p>Candidates should be able to demonstrate a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• the role of marketing, including assessing consumer needs, product development, pricing, promotion and distribution;</li> <li>• advertising;</li> <li>• design rights and patents.</li> </ul>
Legislation	<p>Candidates should be able to demonstrate a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• trade description and sale of goods;</li> <li>• BSI standards applied to products/systems;</li> <li>• labelling;</li> <li>• the implications of intellectual property, registered designs, registered trade marks and copyright;</li> <li>• regulations.</li> </ul>
Health and Safety of designers, makers and the public	<p>Candidates should demonstrate a knowledge and understanding of health and safety issues relating to:</p> <ul style="list-style-type: none"> <li>• the regulatory and legislative framework related to materials and equipment using Health And Safety At Work (HASAW);</li> <li>• COSHH;</li> <li>• the protection of the worker/operator;</li> <li>• the protection of the user/customer;</li> <li>• the protection of the environment;</li> <li>• risk assessment.</li> </ul>

The impact of design and manufacturing on the environment	<p>Candidates should be able to demonstrate a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• issues relating to global sustainable development;</li> <li>• the energy needs during the life of a product or system, life cycle assessment;</li> <li>• the terms availability, conservation, pollution relating to energy;</li> <li>• recycling and green issues in product and systems design.</li> </ul>
Value issues	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>• explore environmental, moral, economic and social issues related to product design and manufacture;</li> <li>• examine the effect of fashion, trends, taste, style;</li> <li>• examine the effect of new technological developments;</li> <li>• examine ethnic and cultural influences on the design and manufacture of products.</li> </ul>
Aesthetics and function, shape, form, colour and taste; the study of aesthetics should not be considered in isolation but should pervade the whole course	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>• develop a critical awareness of designed objects/products in such terms as colour, form, shape, taste, texture and surface finish;</li> <li>• consider the way aesthetic aspects influence appearance, contrast, composition, harmony/disharmony.</li> </ul>
Ergonomics and anthropometrics	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>• demonstrate an understanding of ergonomics when designing products;</li> <li>• interpret and apply anthropometric data when designing.</li> </ul>
Technical data	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>• use and interpret technical data.</li> </ul>
Principles and techniques of testing applied to product design	<p>Candidates should be;</p> <ul style="list-style-type: none"> <li>• aware of a range of tests to identify characteristic/properties of materials.</li> </ul>
Quality control and quality assurance	<p>Candidates should be able to explain:</p> <ul style="list-style-type: none"> <li>• quality control;</li> <li>• quality assurance;</li> <li>• 'Total Quality Management' (TQM).</li> </ul>
Smart and modern materials	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>• demonstrate an understanding of up-to-date development of materials and their application in product design.</li> </ul>

## Built environment and construction

### Substructure

Candidates should develop a knowledge and understanding of:

- procedures for site preparation: walk-over, desk top and soil investigations;
- functional requirements of a foundation: strength, stability, soil types and ground movement;
- the selection and uses of foundation types: deep narrow strip, wide strip, raft, pad, and short bored pile;
- temporary supports for foundation trenches: timbering, trench boxes and vertical steel sheeting.

### Floors

Candidates should develop a knowledge and understanding of:

- functional requirements of a floor: strength, stability, resistance to ground moisture, durability, fire safety, and the resistance to the passage of sound and heat;
- the selection and use of ground floor types: ground supported concrete slab, suspended concrete slab, suspended pre-cast concrete floor slab and suspended timber;
- the selection and use of upper floor types: reinforced concrete, suspended timber and double floor with a steel beam;
- the selection and use of floor finishes: timber strips and tongue and groove boarding, wood blocks, particle board and plywood panels.

### Walls

Candidates should develop a knowledge and understanding of:

- functional requirements of a wall: strength, stability, resistance to weather, durability, fire safety, resistance to the passage of heat and sound, security and aesthetics;
- the selection and use of external wall types: cavity walls in masonry, solid walls, timber and light gauge steel framed;
- the selection and use of supports over openings: arches, concrete and pressed steel lintels;
- the selection and use of internal non-load-bearing partition walls: timber, masonry and proprietary types.

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Roofs

Candidates should develop a knowledge and understanding of:

- functional requirements of a roof: strength, stability, resistance to weather, durability, fire safety, resistance to the passage of heat, sound and air leakage, security and aesthetics;
- the selection and use of roof types: double, pre-fabricated trussed rafter and flat.

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Internal surface finishes

Candidates should develop a knowledge and understanding of:

- functional requirements of an internal surface finish: durability, aesthetics, ease of cleaning and prevention of mould growth or insect attack;
  - the selection and use of internal surface finishes: wet finishes, dry linings, joinery in softwood and hardwood, self finishes and paint finishes.
-

## Engineering

### Engineering processes

Candidates should develop a knowledge and understanding of:

- common processes for working with engineering materials – drilling, sawing, shaping, abrading;
- processes used to manufacture products from metal – milling, turning, casting, modifying characteristics using heat, pressing and stamping;
- processes used to manufacture products from plastic – compression moulding, injection moulding, vacuum forming, rotational moulding, extrusion and blow moulding;
- the design of simple jigs, presses and moulds;
- joining methods using fittings, adhesives, heat and common joints.

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### Engineering drawing techniques

Candidates should develop a knowledge and understanding of:

- freehand sketching, isometric projection, perspective drawing; block diagrams, flow diagrams, schematic diagrams, circuit diagrams, 3rd angle projection, assembly/exploded drawings and diagrams.
-



Engineering materials	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• the selection and use of common ferrous and nonferrous metals;</li> <li>• mild steel, high carbon steels, copper and alloys of brass;</li> <li>• aluminium and tin, zinc, stainless steels, cast iron;</li> <li>• the properties of metal and metal products – strength, toughness, ductility and malleability, weight, durability and thermal and electrical conductivity in terms of suitability for specific consumer products;</li> <li>• the selection and use of common thermoplastics and thermosetting plastics – polystyrene, polyethylene, acrylic, polypropylene, PVC, ABS and PET, phenol resins, phenol formaldehyde, melamine formaldehyde, urea formaldehyde, epoxy resins;</li> <li>• the selection and use of common composite materials, Kevlar, carbon fibre, GRP;</li> <li>• the properties of plastics: hardness, brittleness, tensile strength, plasticity, compressive strength, shear strength, strength to weight ratio, chemical resistance, elasticity, stiffness and impact resistance;</li> <li>• ceramics and ceramic composites;</li> <li>• up-to-date developments of new materials and their potential applications.</li> </ul>
Engineering components	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• mechanical components: nuts, bolts, screws, springs, rivets, pins, keys, drive mechanisms, knock down fittings.</li> </ul>
Engineering quality control	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• tolerances, fit, performance, finish.</li> </ul>
Engineering sectors	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• why engineering sectors exist;</li> <li>• the advantages of belonging to a sector;</li> <li>• the relationships between sectors;</li> <li>• the modern technologies and materials used in sectors.</li> </ul>
Engineering systems and control	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• Computer Integrated Engineering (CIE), Programmable Logic Controllers (PLCs), robotics, automation, embedded systems in industrial appliances.</li> </ul>

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Engineering principles

Candidates should develop a knowledge and understanding of:

- dynamics: linear, angular and rotary acceleration/deceleration, centripetal motion, momentum;
  - statics – basic principles of forces and moments;
  - stresses – compression, torsion, tensile and shear.
-

## Food

## Nutrients

Candidates should develop a knowledge and understanding of:

- the functions and working properties of protein; the nutritional, physical and sensory functions of meat, fish, eggs, milk, cheese and vegetarian alternatives; the effect of processing on these foods;
- the functions and working properties of lipids; the nutritional, physical and sensory functions of fats and oils; the effect of processing on these foods;
- the functions and working properties of carbohydrates; the nutritional, physical and sensory functions of monosaccharides, disaccharides and polysaccharides; the effect of processing on these foods;
- nutritional properties, sources and loss through processing of vitamins A, B, C and D;
- nutritional properties, sources and loss through processing of the minerals iron, calcium, phosphorus, and sodium;
- nutritional theories underlying the principles of product development;
- the fortification of food products;
- the use of Daily Recommended Values (DRVs) to produce targeted products;
- up-to-date developments of new proteins, lipids and carbohydrates and their potential application.

## Sensory characteristics of food

Candidates should develop a knowledge and understanding of:

- organoleptic qualities of food products – taste, aroma, flavour, texture, mouthfeel, appearance and sound;
- new developments in food design.

## Working characteristics of a range of materials and components

Candidates should develop a knowledge and understanding of:

- the use and choice of a range of materials, components and additives in commercially manufactured food products to achieve thickening, aeration, emulsification, coagulation, gelation, shortening, binding, flavouring, colouring, stabilising and extending storage life;
- enzymic and non-enzymic browning reactions in foods.

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Principles of preservation and prolonging the shelf life of food products

Candidates should develop a knowledge and understanding of:

- the factors influencing the growth of micro-organisms;
  - the underlying principles in preservation – high/low temperature, removal of moisture, change of pH and the effect on the physical, sensory and nutritional properties of food materials;
  - the application of heat in pasteurisation (UHT), sterilisation, canning;
  - the removal or binding of water in food preservation;
  - preservatives in chemical preservation using acids;
  - the removal of heat in chilling, freeze drying and freezing;
  - rancidity of fats and its prevention;
  - the main materials used in food packaging to extend shelf life – glass, paper and board, metal foil and plastics;
  - the methods used to package food products – shrink wrap, aseptic Modified Atmosphere Packaging (MAP), vacuum packing;
  - new developments in processing techniques and their effect on food products.
-

## Graphic products

Paper and boards	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• the selection and use of common papers and boards: foil laminates, substrates;</li> <li>• common paper terms: coating, filler, laminate, opacity, ream;</li> <li>• the properties of papers and boards – water resistance, strength, absorbency, density, durability;</li> <li>• modelling and display materials – card and foam board;</li> <li>• bleached and unbleached forms;</li> <li>• bonded and corrugated forms;</li> <li>• up-to-date developments of new and smart materials and their application in graphic products.</li> </ul>
Plastic sheet	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• modelling and display materials – corrufute, high impact polystyrene, acrylic, styrofoam;</li> <li>• polypropylene (for laminates), PVC, LDPE.</li> </ul>
Pop ups and mechanical techniques	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• V folds, single and multiple;</li> <li>• m folds;</li> <li>• parallelograms, single and multiple;</li> <li>• movements using slides and moving arms – linear, rotary, oscillating, reciprocating;</li> <li>• linkages, rotary to linear conversions, oscillating.</li> </ul>
Finishing processes	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• varnishes – roller coat, UV, spirit;</li> <li>• spot varnishing;</li> <li>• lamination;</li> <li>• embossing;</li> <li>• foil blocking;</li> <li>• paper coatings and fillers;</li> <li>• cropping, trimming.</li> </ul>
Package and carton design and construction	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• closures – tab-lock, tuck-flap, slit-lock, postal-lock, crash base (+automatic);</li> <li>• nets for simple and complex products;</li> <li>• press forme design and construction.</li> </ul>

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Manufacturing processes

Candidates should develop a knowledge and understanding of:

- common processes for working models and prototype graphic products;
- image setting, plate/screen production;
- photomechanical transfer techniques;
- commercial printing processes – offset lithography, screen process printing, flexography, gravure, digital printing;
- vinyl cutting;
- cutting and forming processes – die cutting, folding, perforating, laser cutting;
- paper and board manufacture and production.

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Holography

Candidates should develop a knowledge and understanding of:

- the use of holograms within graphic products for functional, aesthetic and security applications.
-

## Manufacturing

Manufacturing processes	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• one-off, batch, high volume production systems;</li> <li>• modular/cell production systems;</li> <li>• just-in-time manufacture;</li> <li>• repetitive flow;</li> <li>• continual flow;</li> <li>• in-line assembly;</li> <li>• cell production;</li> <li>• automated production;</li> <li>• robotics;</li> <li>• bought-in parts and components, standardised parts;</li> <li>• the implications of these industrial production processes/procedures;</li> <li>• appropriate manufacturing methods that take into account the properties of different materials;</li> <li>• the effects of the manufacturing process on the properties and structure of materials.</li> </ul>
Manufacturing, production and planning	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• preparation of materials;</li> <li>• processing of materials;</li> <li>• assembly stages during production;</li> <li>• sequencing and timings of manufacturing stages;</li> <li>• production planning;</li> <li>• costing.</li> </ul>
Manufacturing quality control	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• recording and use of data, tolerances, fit, finish, performance;</li> <li>• quality control;</li> <li>• quality assurance;</li> <li>• Total Quality Management (TQM).</li> </ul>
Manufacturing sectors	<p>Candidates should develop a knowledge and understanding of:</p> <ul style="list-style-type: none"> <li>• why manufacturing sectors exist;</li> <li>• the advantages of belonging to a sector;</li> <li>• the relationships between sectors;</li> <li>• the modern technologies and materials used in sectors.</li> </ul>

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Manufacturing systems and control

Candidates should develop a knowledge and understanding of:

- monitoring, testing and tracking during production;
- Computer Integrated Manufacturing (CIM), Programmable Logic Controllers (PLCs), robotics, automation, embedded systems in industrial appliances.

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Manufacturing methods

Candidates should develop a knowledge and understanding of:

- common processes for working with materials – drilling, sawing, shaping, abrading;
  - processes used to manufacture products from wood – laminating, bending, routing/profiling, turning;
  - processes used to manufacture products from metal – milling, turning, casting, modifying characteristics using heat, pressing and stamping;
  - processes used to manufacture products from plastic – compression moulding, injection moulding, vacuum forming, rotational moulding, extrusion and blow moulding;
  - processes, materials and components used to manufacture products from differing materials;
  - processes used in assembling and joining similar and dissimilar materials;
  - the design of simple jigs, presses and moulds;
  - joining methods using fittings, adhesives, heat and common joints.
-



## Resistant materials

## Metal

Candidates should develop a knowledge and understanding of:

- the selection and use of common ferrous and nonferrous metals ;
- mild steel, high carbon steels, stainless steels, cast iron, zinc, copper;
- brasses and aluminium alloys and tin alloys;
- the properties of metal and metal products – strength, toughness, ductility and malleability, weight, durability and thermal and electrical conductivity in terms of suitability for specific consumer products;
- up-to-date developments of new and smart metal alloys and their potential application.

## Plastic

- the selection and use of common thermoplastics and thermosetting plastics – polystyrene, polyethylene, acrylic, polypropylene, PVC, ABS and PET, phenol resins, phenol formaldehyde, melamine formaldehyde, urea formaldehyde, epoxy resins;
- the selection and use of common composite materials, Kevlar, carbon fibre;
- the properties of plastics – hardness, brittleness, tensile strength, plasticity, compressive strength, sheer strength, strength to weight ratio, chemical resistance, elasticity, stiffness and impact resistance;
- up-to date developments of new and smart plastic materials and their potential applications.

## Wood

- the selection and use of the following hardwoods and softwoods: beech, ash, oak, jelutong, sycamore, maple, teak; cedar, pine, deal;
- the selection and use of the following manufactured boards: plywood, laminated boards, chip and compressed boards;
- the properties of wood and wood products – hardness, flexibility, tensile strength, compressive strength, sheer strength, strength to weight ratio, chemical resistance, elasticity, stiffness and impact resistance;
- up-to-date developments of new forms of wood products and their potential applications.

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**Surface finishes**

Candidates should develop a knowledge and understanding of:

- the nature and suitability of surface finishes and coatings across a range of products relating to decoration, resistance to decay and wear, absorption and aesthetic qualities;
- methods of preparing surfaces to accept finishes;
- the following finishes for metal – paints, dip coating, varnishes, lacquering and electroplating, galvanising, plastic coating;
- the following finishes for plastic – edge polishing, chemical finishing;
- the following finishes for wood – varnishing, waxing, oiling, stains, polishing, interior and exterior finishes, chemical preservatives, pressure impregnation, lipping.

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**Manufacturing processes**

Candidates should develop a knowledge and understanding of:

- common processes for working with resistant materials – drilling, sawing, shaping, abrading;
  - processes used to manufacture products from metal – milling, turning, casting, modifying characteristics using heat, pressing and stamping;
  - processes used to manufacture products from plastic – compression moulding, injection moulding, vacuum forming, rotational moulding, extrusion and blow moulding;
  - processes used to manufacture products from wood – laminating, bending, routing/profiling;
  - the design of simple jigs, presses and moulds;
  - joining methods using fittings, adhesives, heat and common joints.
-

## Systems and control

Electrical, electronic, mechanical, pneumatic systems

Candidates should develop a knowledge and understanding of:

- input devices:
  - potential divider, LDR, photodiode, phototransistor, slotted/reflective opto-switch, IR emitting diode and sensor, thermistor, temperature-sensing ic, microphone, strain gauge, pressure-sensing transducer, switches including reed, micro, pressure, thermal, tilt and float;
- processing devices and techniques:
  - operational amplifier, inverting, non-inverting and comparator
  - methods of producing monostable and astable signal, 555 ic;
  - AND, NAND, OR, NOR, NOT, EOR logic gates;
  - D-type flip-flops, debouncing circuit, Schmitt trigger inputs, counter ic, conversion from BCD to driver for 7-segment display, BCD-to-decimal decoder ic;
  - N-channel MOSFET, thyristor pulse-width-modulation (PWM);
- output devices:
  - DC motor, fan, relay, DC solenoid;
  - optical devices, 7-segment display, multiplexed 7-segment LED display; liquid crystal displays, multi-digit 7-segment, 'intelligent' alpha-numeric;
  - piezo-electric sounder, loudspeaker, stepper motor, miniature servo;
- power sources:
  - mains, transformed supplies and battery types and source; use of voltage regulator and zener diode;
- structures:
  - tension, compression, torsion, bending;
  - stress, strain, elasticity, Young's modulus, ultimate tensile strength, ultimate shear strength, safety factor, how the cross-sectional shape of a member affects its rigidity, modes of failure;

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Electrical, electronic, mechanical, pneumatic systems cont'd

- mechanisms:
  - gear systems;
  - transfer of drive;
  - torque (moment), work done and power in linear and rotating systems;
- pneumatics:
  - pneumatic valves, components and cylinders in systems;
  - up-to-date developments of new devices and materials and their applications in electrical/electronic, mechanical and pneumatic systems and control technology.

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Programmable and control devices

Candidates should develop a knowledge and understanding of:

- the use of programmable devices to solve problems in system design;
- the integration of programmable control devices with electrical/electronic, mechanical and pneumatic systems.

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Manufacturing processes

Candidates should develop a knowledge and understanding of:

- how to design and draw electrical/electronic, mechanical and pneumatic circuit and constructional diagrams from a given specification, situation or flowchart;
  - the production of a pcb in a workshop situation and the use of surface mount technology (SMT), pick and place machinery and flow soldering in industry;
  - how to produce flowcharts for microcontroller and system designs given a specification, situation or circuit;
  - how to interface electrical/electronic circuits with mechanical and pneumatic systems and components.
-

## Textiles

## Performance characteristics

Candidates should develop a knowledge and understanding of:

- tensile strength, elasticity, resilience, durability, weight, thermal conductivity/insulation, chemical resistance, flammability, absorbency, water repellence, reaction to light, micro-organisms, air and water permeability and electrostatic charge.

## Fibres

Candidates should develop a knowledge and understanding of:

- the performance characteristics, selection and use of natural and manufactured fibres:
  - natural fibres – cotton, flax, wool, silk;
  - regenerated fibres, viscose;
  - manufactured fibres – synthetic fibres; polyamide, polyester, acrylic, elastomeric;
  - fluorofibres, chlorofibres, glass, carbon, metal.

## Yarns

Candidates should develop a knowledge and understanding of:

- the performance characteristics, selection and use of staple and filament yarns:
  - yarns as single yarn;
  - spun yarns including worsted/woollen, filament;
  - finishes applied to yarns, texturing and structural effects.

## Mixtures, blends and laminates

Candidates should develop a knowledge and understanding of:

- the reasons for mixing and blending fibres and yarns, and the performance characteristics of the yarns and fabrics produced.

## Fabric construction

Candidates should develop a knowledge and understanding of:

- the performance characteristics, selection and use of a variety of fabrics:
  - woven fabrics – plain, twill, sateen, loop and cut pile;
  - knitted fabrics, warp knits – single and double jersey; weft knit – tricot and lock knit; non-woven fabrics – felt, wool felts, bonded fabrics.

## Smart and modern

Candidates should develop a knowledge understanding of:

- new forms of fibres and fabrics and their applications in product design.

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**Surface finishes**

Candidates should develop a knowledge and understanding of:

- the nature and suitability of surface finishes and coatings across a range of products:
  - for functional purposes – resistance to water, stains, decay and wear, to improve;
  - insulation properties, crease resistance, anti-shrink , easy care, anti-static, flame resistance, anti-pilling, laminating, brushing, moth and rot proofing and hygienic;
  - finishes that enhance appearance – calendering, stone and sand washing, transfer printing, screen printing, block and roller printing, digital printing;
- dyeing methods – vat, batch, discharge and resist.

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**Manufacturing processes**

Candidates should develop a knowledge and understanding of:

- forming processes for fabrics, the production and use of pattern pieces to cut fabrics to accurate sizes and shapes;
  - plotter/cutters, laser cutters, water jet and die cutters;
  - disposal of fullness – gathering, darts, pleating, and tucks;
  - reinforcing materials to improve strength/durability – laminating, quilting, interfacing, reinforced stitching;
  - seams – the plain/open seam, double stitched seam and the French seam;
  - seam finishes, hems, facings, bias binding, overlocking;
  - fastenings – zips, buttons and buttonholes or loops, Velcro, poppers, parachute clips, hooks and eyes, laces and ties, buckles and toggles;
  - adhesives – iron-on interfacings, Bondaweb, taping of seams;
  - decorative techniques – appliqué, quilting, free machine embroidery, computer controlled stitching.
-

## Component 2

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This section assesses the abilities of candidates to make immediate design responses to a given situation. It is intended to discriminate by identifying those candidates who can effectively use their experiences and knowledge in designing, making and evaluating.

The question paper consists of **eight** questions. Candidates will answer **one** question only on pre-printed OCR A3 sheets.

There are a total of 54 marks for the question. Each question will follow a common format and a generic mark scheme will be used for all questions. There will be one question for each of the eight focus areas:

- built environment and construction;
- engineering;
- food;
- graphic products;
- manufacturing;
- resistant materials;
- textiles;
- systems and control.

Candidates are required to respond to a given design situation. They will start by producing a specification and then produce a range of developed ideas. The ideas must be innovative and consider manufacturing/construction techniques, materials, components or ingredients and appropriate measurements. Ideas must be evaluated with reference to the specification and volume production. Sketches and appropriate annotation should be used to show a final developed outcome. Specific features must be identified along with justification for these choices. Candidates will be marked on their ability to communicate their ideas effectively.

Marks are allocated as follows:

- |  |             |
|--|-------------|
| • specification                              | <b>[6]</b>  |
| • range of innovative ideas with development | <b>[33]</b> |
| • final developed outcome                    | <b>[9]</b>  |
| • efficient communication                    | <b>[6]</b>  |
| Total  | <b>[54]</b> |

# 4 Schemes of Assessment

## 4.1 AS GCE Scheme of Assessment

### AS GCE Design and Technology: Product Design (H053)

#### AS F521: *Advanced Innovation Challenge*

40% of the total AS GCE marks Examined **Assessment Criteria:** Please refer to Appendix B at the back of these specifications.

7 h

80 marks

#### Session 1

- |  |             |
|--|-------------|
| • Initial thoughts, design brief and specification | <b>[9]</b>  |
| • Designing  | <b>[12]</b> |
| • Design development and planning                  | <b>[9]</b>  |

#### Session 2

- |                           |             |
|---------------------------|-------------|
| • Making                  | <b>[22]</b> |
| • Analysis and evaluation | <b>[8]</b>  |

#### Session 3

- |                    |             |
|--------------------|-------------|
| • Reflection paper | <b>[20]</b> |
|--------------------|-------------|

Total	<b>[80]</b>
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This paper is taken over three sessions during a period in the exam series.

The advanced challenge requires candidates to work with materials in either a supervised examination room or design workshop. In Session 1, with their job bag as inspiration, candidates produce a specification and design brief using annotated sketches, notes and models to describe their ideas and designs. They choose one design to take forward into Session 2. In Session 2 candidates model their chosen design, record their thoughts and further ideas in their workbook, and evaluate their final design and model against the original specification. In Session 3 candidates have the chance to reflect on the product designed in Sessions 1 and 2 in a written examination.

#### Session 1

Initial thoughts	30 minutes to produce a design specification	<b>9 marks</b>
Designing	80 minutes to propose a design	<b>12 marks</b>
Design development	70 minutes to improve and modify the design	<b>9 marks</b>

#### Session 2

Making	100 minutes to develop the model	<b>22 marks</b>
Analysis and evaluation	80 minutes to evaluate the design	<b>8 marks</b>

#### Session 3

Reflection examination paper 60 minutes with questions from a design, marketing or manufacturing perspective. Candidates answer both questions.



**AS F522: Product Study**

60% of the total AS GCE marks  
Coursework

Overview of coursework

30 h  
120 marks

**Assessment Criteria:** Please refer to Appendix C at the back of these specifications.

- |   |             |
|---|-------------|
| • Product focus and analysis                        | <b>[8]</b>  |
| • Strengths and weaknesses comparison               | <b>[12]</b> |
| • Moral implications                                | <b>[8]</b>  |
| • Brief and specification for improving the product | <b>[8]</b>  |
| • Development of improvement                        | <b>[56]</b> |
| • Testing of final developed idea                   | <b>[12]</b> |
| • Summary of results                                | <b>[8]</b>  |
| • Communication                                     | <b>[8]</b>  |

**TOTAL** **[120]**

**Product focus and analysis**

- Candidates:
- select a specific single product, which has a focus within their area of expertise suited to analysis and development within a prescribed time scale; examine and give the intended purpose of the selected single product, including the needs of both the manufacturer and consumer; identify the original key criteria against which the selected product was developed.

**Strengths and weaknesses comparison**

- Candidates:
- analyse the strengths and weaknesses of the single selected product;
  - compare the product to other similar products in terms of function, suitability of materials, components or ingredients and manufacturing processes used, ergonomic suitability, aesthetics and cost.

**Moral implications**

- Candidates:
- identify and analyse the relevant moral implications associated with environmental, social and economic issues in the design and use of a product.

**Brief and specification for improving the product**

- Candidates:
- write a detailed design brief for improving the selected product in some way;
  - develop and justify an objective design specification.

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**Development of improvement**

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- Candidates:
- use annotated sketching, real-time digital images and interactive dialogue to generate and record a wide range of initial ideas, which explore possible improvements;
  - photograph, record and comment as it actually takes place;
  - make sufficient appropriate prototype models to establish the validity of the proposed idea in terms of:
    - physical requirements, eg construction, movement, stability, composition, strength;
    - aesthetic qualities and/or taste as appropriate;
  - suitable manufacturing processes;
  - suitability of materials, components or ingredients;
  - test and evaluate developed ideas against the specification in real time and justify the choice of one idea worthy of being taken forward.

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*This information should be presented in an integrated form and recorded in real time.*

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**Testing of final developed idea**

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- Candidates:
- use an appropriate method or system to formally test and evaluate their final developed idea, or the suitability of the proposed materials, components or ingredients;
  - present results in real time, clearly and concisely.

**Summary of results**

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- Candidates:
- produce a summary of the results of the development and prototype modelling, which includes analysis of information gained from the prototypes, and details and analysis of the results gained from the testing;
  - provide suggestions for further improvement to the proposed idea.

**Communication**

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- Candidates:
- use a combination of text, graphical techniques, digital technology and interactive dialogue, as appropriate, to present information.
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## 4.2 Advanced GCE Scheme of Assessment

### Advanced GCE Design and Technology: Product Development (H453)

AS units as above, Unit 1 being 20% of the total Advanced GCE marks and Unit 2 being 30% of the Advanced GCE marks.

#### A2 F523: *Design, Make and Evaluate*

30% of the total Advanced GCE marks

**Assessment Criteria:** Please refer to Appendix D at the back of these specifications.

Coursework

40 h

120 marks

- |              |   |      |
|--------------|---|------|
| • Section 1  | Design brief  | [3]  |
| • Section 2  | Information, inspiration and influences                 | [9]  |
| • Section 3  | Design specification                                    | [3]  |
| • Section 4a | Design, design development and making                   | [57] |
| • Section 4b | Innovation  | [15] |
| • Section 5  | Testing and independent evaluation of the final product | [9]  |
| • Section 6  | Marketing presentation                                  | [15] |
| • Section 7  | Review and reflection                                   | [9]  |

TOTAL	[120]
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#### **Design brief**

Candidates:                      • present a design brief for a marketable product.

#### **Information, inspiration and influences**

Candidates:                      • obtain information relevant to the design of the product;  
    • present a range of evidence to show the sources of inspiration and influences on the designing.

#### **Design specification**

Candidates:                      • produce a design specification for the product;  
    • justify the design requirements.

#### **Design, design development and making**

Candidates:                      • demonstrate competence in the design, design development and making of the product, to include the following package of evidence:

- the generation and exploration of design possibilities;
- the use of digital technologies;
- experimenting and modelling;
- the refining and defining of a final design through ongoing evaluation;
- the planning and making of the product.

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**Innovation**

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Candidates:                   • show innovation.

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**Testing and independent evaluation of the final product**

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Candidates:                   • show evidence of the testing of the final product against the specification;  
                                     • identify and state strengths and weaknesses in the product;  
                                     • respond to independent evaluation.

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**Marketing presentation**

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Candidates:                   • using appropriate techniques, create a marketing presentation suitable for the final product.

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**Review and reflection**

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Candidates:                   • review and reflect on the effectiveness of the designing and making process that led to the final product;  
                                     • consider the possible wider implications and impact of the product, including possible future developments.

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**A2 F524: Product Design**

20% of the total Advanced GCE marks  
2.5 h written paper  
90 marks

This paper has **two** components:

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**Component 1:** Candidates are required to answer **one** question from a choice of **eight**. The **eight** questions represent each of the material focus areas: 36 marks are allocated to this component, 24 of which will be made up from the generic core section that all candidates must study.

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**Component 2:** Candidates are required to answer **one** question from a choice of **eight**. The **eight** questions represent each of the material focus areas. The questions are designed to assess the candidate's ability to respond to a design situation in a material focus area of their choice. Although candidates can choose the same focus area as Component 1, it is not a requirement, and candidates may select from a different material area if they wish. Candidates respond on supplied A3 sheets.

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Component 2 is marked to a generic mark scheme, which is repeated on the A3 sheets for candidates to refer to during the examination: 54 marks are available for this component. Amendments, if any, to the mark scheme are published in the report to centres (Summer series) and apply to Spring and Summer series of the next year. It will also be posted on the OCR website [www.ocr.org.uk](http://www.ocr.org.uk).

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## 4.3 Unit Order

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The normal order in which the unit assessments could be taken is AS Units F521 and F522 in the first year of study, leading to an AS GCE award, then A2 Units F523 and F524 leading to the Advanced GCE award. However, the unit assessments may be taken in any order.

## 4.4 Unit Options (at AS/A2)

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There are no optional units in the AS GCE specification; for AS GCE *Design and Technology: Product Design* candidates must take AS Units F521 and F522.

There are no optional units in the Advanced GCE specification; for A2 GCE *Design and Technology: Product Design* candidates must take AS Units F523 and F524.

## 4.5 Synoptic Assessment (A Level GCE)

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Synoptic assessment is included wholly in the A2 Units.

Synoptic assessment tests the candidates' understanding of the connections between different elements of the subject.

## 4.6 Assessment Availability

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There is one examination series each year in June.

From 2014, both AS units and A2 units will be assessed in June only.

## 4.7 Assessment Objectives

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Candidates are expected to demonstrate the following in the context of the content described:

### AO1 Demonstrate knowledge and understanding

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- Candidates should demonstrate specific knowledge and understanding and be able to apply that knowledge and understanding in combination with appropriate skills in their designing; they should communicate ideas and outcomes and demonstrate strategies for evaluation.

### AO2 Demonstrate and apply skills, knowledge and understanding

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- Candidates should be able to demonstrate and apply skills, knowledge and understanding of relevant materials, processes and techniques, and use materials and equipment to produce suitable and appropriate outcomes; they should be able to communicate ideas and outcomes and demonstrate strategies for evaluation.

### AO weightings in AS GCE

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Unit	% of AS GCE		Total
	AO1	AO2	
AS F521: <i>Advanced Innovation Challenge</i>	20	20	40%
AS F522: <i>Product Study</i>	40	20	60%
	60%	40%	100%

### AO weightings in Advanced GCE

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Unit	% of Advanced GCE		Total
	AO1	AO2	
AS F521: <i>Advanced Innovation Challenge</i>	10	10	20%
AS F522: <i>Product Study</i>	20	10	30%
A2 F523: <i>Design, Make and Evaluate</i>	10	20	30%
A2 F524: <i>Product Design</i>	10	10	20%
	50%	50%	100%

## 4.8 Quality of Written Communication

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*Quality of Written Communication* is assessed in Units F521 and F524 and credit may be restricted if communication is unclear.

Candidates will:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- select and use a form and style of writing appropriate to purpose and to complex subject matter;
- organise information clearly and coherently, using specialist vocabulary when appropriate.



# 5 Technical Information

## 5.1 Making Unit Entries

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Please note that centres must be registered with OCR in order to make any entries, including estimated entries. It is recommended that centres apply to OCR to become a registered centre well in advance of making their first entries. Centres must have made an entry for a unit in order for OCR to supply the appropriate forms or moderator details for coursework.

**It is essential** that unit entry codes are quoted in all correspondence with OCR. See Sections 4.1 and 4.2 for these unit entry codes.

## 5.2 Making Qualification Entries

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Candidates must enter for qualification certification separately from unit assessment(s). If a certification entry is **not** made, no overall grade can be awarded.

Candidates may enter for:

- AS GCE certification (entry code H053).
- Advanced GCE certification (entry code H453).

A candidate who has completed all the units required for the qualification, and who did not request certification at the time of entry, may enter for certification either in the same examination series (within a specified period after publication of results) or at a later series.

AS GCE certification is available from June 2014.  
Advanced GCE certification is available from June 2014.

## 5.3 Grading

All GCE units are awarded a-e. The Advanced Subsidiary GCE is awarded on the scale A-E. The Advanced GCE is awarded on the scale A-E with access to an A\*. To be awarded an A\*, candidates will need to achieve a grade A on their full A level qualification and an A\* on the aggregate of their A2 units. Grades are reported on certificates. Results for candidates who fail to achieve the minimum grade (E or e) will be recorded as *unclassified* (U or u) and this is **not** certificated.

A Uniform Mark Scale (UMS) enables comparison of candidates' performance across units and across series and enables candidates' scores to be put on a common scale for aggregation purposes. The two-unit AS GCE has a total of 200 *uniform* marks and the four-unit Advanced GCE has a total of 400 *uniform* marks.

OCR converts each raw mark for each unit to a uniform mark. The maximum *uniform* mark for any unit depends on that unit's weighting in the specification. In these Design and Technology specifications, the four units of the Advanced GCE specification have UMS weightings of 20%/30%/30%/20% (and the two units of the AS GCE specification have UMS weightings of 40%/60%). The UMS totals are 80/120/120/80 respectively. Each unit's *raw* mark grade boundary equates to the *uniform* mark boundary at the same grade. Intermediate marks are converted on a pro-rata basis.

*Uniform* marks correspond to *unit* grades as follows:

(Advanced GCE) Unit Weighting	Maximum Unit Uniform Mark	Unit Grade					u
		a	b	c	d	e	
30%	120	120–96	95–84	83–72	71–60	59–48	47–0
20%	80	80–64	63–56	55–48	47–40	39–32	31–0

OCR adds together the unit *uniform* marks and compares these to pre-set boundaries (see the table below) to arrive at *qualification* grades.

Qualification	Qualification Grade					U
	A	B	C	D	E	
AS GCE	200–160	159–140	139–120	119–100	99–80	79–0
Advanced GCE	400–320	319–280	279–240	239–200	199–160	159–0

Candidates achieving at least 320 UMS marks in their Advanced GCE, ie grade A, and who also gain at least 180 UMS in their two A2 units, will receive an A\* grade.

## 5.4 Result Enquiries and Appeals

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Under certain circumstances, a centre may wish to query the grade available to one or more candidates or to submit an appeal against an outcome of such an enquiry. Enquiries about unit results must be made immediately following the series in which the relevant unit was taken.

For procedures relating to enquires on results and appeals, centres should consult the *Administration Guide for General Qualifications* and the document *Enquiries about Results and Appeals – Information and Guidance for Centres* produced by the Joint Council. Copies of the most recent editions of these papers can be obtained from OCR.

## 5.5 Shelf-Life of Units

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Individual unit results, prior to certification of the qualification, have a shelf-life limited only by that of the qualification.

## 5.6 Unit and Qualification Resits

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There is no restriction on the number of times a candidate may resit each unit before entering for certification for an AS GCE or Advanced GCE.

Candidates may enter for the full qualifications an unlimited number of times.

## 5.7 Guided Learning Hours

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AS GCE Design and Technology: Product Design requires **180** guided learning hours in total.  
Advanced GCE Design and Technology: Product Design requires **360** guided learning hours in total.

## 5.8 Code of Practice/Subject Criteria/Common Criteria Requirements

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These specifications comply in all respects with current *GCSE, GCE, GNVQ and AEA Code of Practice* as available on the QCA website, the subject criteria for GCE Design and Technology: Product Design and *The Statutory Regulation of External Qualifications 2004*.

## 5.9 Arrangements for Candidates with Particular Requirements

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For candidates who are unable to complete the full assessment or whose performance may be adversely affected through no fault of their own, teachers should consult the *Access Arrangements and Special Consideration Regulations* and *Guidance Relating to Candidates who are Eligible for Adjustments in Examinations* produced by the Joint Council. In such cases advice should be sought from OCR as early as possible during the course.

## 5.10 Prohibited Qualifications and Classification Code

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Candidates who enter for the OCR GCE specifications may not also enter for any other GCE specification with the certification title *Design and Technology* in the same examination series.

Every specification is assigned to a national classification code indicating the subject area to which it belongs.

Centres should be aware that candidates who enter for more than one GCE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Achievement and Attainment Tables.

The classification code for these specifications is 7410.

## 5.11 Coursework Administration/Regulations

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### Supervision and Authentication

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As with all coursework, teachers must be able to verify that the work submitted for assessment is the candidate's own work. Sufficient work must be carried out under direct supervision to allow the teacher to authenticate the coursework marks with confidence.

Coursework should be seen as a vehicle for teaching as much as for assessment. Candidates should make their own judgements and decisions and direct their own project work, but teacher advice, support and assistance should be given as part of normal teaching throughout the project, in suggesting approaches, alternatives and possibilities, for example, or directing candidates to appropriate resources. This ensures that the teacher is in a strong position to authenticate the candidate's work fully. Where direct intervention is necessary, this should be clearly acknowledged by candidates.

The nature of some coursework projects at this Advanced level may involve considerable input from industry or involvement by companies and individuals. Industrial links and the use of external support are encouraged, and are a positive aspect in addressing many of the assessment criteria. In such cases it is crucial that there is sufficient in-depth and challenging designing, making and evaluating carried out by the candidate him/herself to satisfy the assessment criteria.

Where some of the coursework is carried out outside the centre, it is important that the teacher is able to authenticate the candidate's work. Sufficient work must be carried out under the direct supervision of the teacher for the whole of the candidate's work to be verified. The work assessed must be solely that produced by the candidate.

Sources of all information and assistance must be clearly acknowledged at the appropriate point in the record of designing and making, or in a separate list or bibliography. This includes extracts from newspapers, magazines, catalogues, websites, CD-ROMs, photocopied materials, and practical assistance with making tasks. This should be seen as a positive aspect, where candidates will be rewarded by incorporating and managing the knowledge and expertise of others to maximise a quality outcome to their project.

### Assessment and Submission of Coursework

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The intention is that assessment of the coursework project should not restrict, interrupt, or influence the natural flow and progression of the candidate's design, development and making of a product to meet a need. The assessment criteria should be seen as providing a framework for assessing the candidate's approach to key elements in that process, the appropriateness, depth and quality of their work, and the level of thinking shown. It is important that assessment does not interfere with the candidate developing and using skills naturally and instinctively, guided by the teacher. Work on the project should be recorded in real time, not retrospectively.

Candidates should structure their work to follow the assessment criteria, and should present their work in section number order. A summary or contents page with a numbering system should be included to help its organisation.

Coursework may be submitted on paper or PowerPoint on CD-ROM/DVD-ROM. Candidates and centres should choose which format is appropriate and present all work in one form or the other.

Electronic evidence must be presented in a format that conforms to the guidelines published by OCR, with clear identification of all evidence submitted.

## Submitting Marks to OCR

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Centres must have made an entry for a unit in order for OCR to supply the appropriate forms or moderator details for coursework. Coursework administration documents are sent to centres on the basis of estimated entries. Marks may be submitted to OCR either via Interchange, on the computer-printed Coursework Mark Sheets (MS1) provided by OCR (sending the top copy to OCR and the second copy to their allocated moderator), or by EDI (centres using EDI are asked to print a copy of their file and sign it before sending to their allocated moderator).

Deadline for the receipt of coursework marks is:  
15 May for the June series

The awarding body must require centres to obtain from each candidate a signed declaration that authenticates the coursework they produce as their own. For regulations governing coursework, centres should consult the *Administration Guide for General Qualifications*. Further copies of the coursework administration documents are available on the OCR website ([www.ocr.org.uk](http://www.ocr.org.uk)).

## Standardisation and Moderation

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All internally assessed coursework is marked by the teacher and internally standardised by the centre. Marks must be submitted to OCR by the agreed date, after which postal moderation takes place in accordance with OCR procedures.

The purpose of moderation is to ensure that the standard for the award of marks in internally assessed coursework is the same for each centre, and that each teacher has applied the standards appropriately across the range of candidates within the centre.

The sample of work that is submitted to the moderator for moderation must show how the marks have been awarded in relation to the marking criteria.

## Minimum Coursework Required

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If a candidate submits no work for a unit, then he or she should be indicated as being absent from that unit on the coursework mark sheets submitted to OCR. If a candidate completes any work at all for that unit then the work should be assessed according to the criteria and marking instructions and the appropriate mark awarded, which may be zero.

## 6 Other Specification Issues

### 6.1 Overlap with other Qualifications

There is a small degree of overlap between the content of these specifications and those for Advanced GCE Home Economics and Electronics.

### 6.2 Progression from these Qualifications

Throughout the course of study, candidates are encouraged to develop a critical awareness of design and technology within society.

These specifications, therefore, provide a suitable foundation for the study of design or related courses in higher education. They are also suitable for candidates intending to pursue careers in areas related to the focus material areas that make up these specifications.

### 6.3 Key Skills Mapping

These specifications provide opportunities for the development of the Key Skills of *Communication, Application of Number, Information Technology, Working with Others, Improving Own Learning and Performance* and *Problem Solving* at Levels 2 and/or 3. However, the extent to which this evidence fulfils the Key Skills criteria at these levels will be totally dependent on the style of teaching and learning adopted for each unit.

The following table indicates where opportunities *may* exist for at least some coverage of the various Key Skills criteria at Levels 2 and/or 3 for each unit.

Unit	C				AoN			IT			WwO			IOLP			PS		
	.1a	.1b	.2	.3	.1	.2	.3	.1	.2	.3	.1	.2	.3	.1	.2	.3	.1	.2	.3
F521	✓	✓	✓	✓				✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
F522	✓		✓	✓				✓	✓	✓				✓	✓	✓	✓	✓	✓
F523	✓		✓	✓				✓	✓	✓				✓	✓	✓	✓	✓	✓
F524	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							

## 6.4 Spiritual, Moral, Ethical, Social, Legislative, Economic and Cultural Issues

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These specifications offer opportunities that can contribute to an understanding of these issues in the following topics:

- the relationship between shape, form, function and the tactile senses within organised human making activities (Units F522, and F523);
- the scale and impact of technology upon natural processes and resources (all Units);
- the impact of design and technological activities upon advanced and developing societies (Units F522 and F523);
- the human dimension – value issues and value systems;
- the moral implications of some applications of technological activities (F521 and F522).

## 6.5 Sustainable Development, Health and Safety Considerations and European Developments

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These specifications support these issues, consistent with current EU agreements, in the following topics:

- Design and technology activities are global and not solely restricted to Europe. Design and making responses are multicultural and arise from identifiable needs and opportunities. These specifications do not make specific reference to European Developments; however, it may be drawn into the course of study in many ways, eg European Safety Standards.
- Health and Safety is referred to in all Units.

## 6.6 Avoidance of Bias

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OCR has taken great care in preparation of these specifications and assessment materials to avoid bias of any kind.

## 6.7 Language

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These specifications and associated assessment materials are in English only.



## 6.8 Disability Discrimination Act Information Relating to these Specifications

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AS/A levels often require assessment of a broad range of competences. This is because they are general qualifications and, as such, prepare candidates for a wide range of occupations and higher level courses.

The revised AS/A level qualification and subject criteria were reviewed to identify whether any of the competences required by the subject presented a potential barrier to any disabled candidates. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject. The findings of this process were discussed with disability groups and with disabled people.

Reasonable adjustments are made for disabled candidates in order to enable them to access the assessments. For this reason, very few candidates will have a complete barrier to any part of the assessment. Information on reasonable adjustments is found in *Access Arrangements and Special Consideration Regulations and Guidance Relating to Candidates who are Eligible for Adjustments in Examinations* produced by the Joint Council (refer to Section 5.9 of this specification).

Candidates who are still unable to access a significant part of the assessment, even after exploring all possibilities through reasonable adjustments, may still be able to receive an award. They would be given a grade on the parts of the assessment they have taken and there would be an indication on their certificate that not all of the competences have been addressed. This will be kept under review and may be amended in the future.

Candidates with a visual impairment may find this subject difficult to access fully.

# Appendix A: Performance Descriptions

Performance descriptions have been created for all GCE subjects. They describe the learning outcomes and levels of attainment likely to be demonstrated by a representative candidate performing at the A/B and E/U boundaries for AS and A2.

In practice most candidates will show uneven profiles across the attainments listed, with strengths in some areas compensating in the award process for weaknesses or omissions elsewhere. Performance descriptions illustrate expectations at the A/B and E/U boundaries of the AS and A2 as a whole; they have not been written at unit level.

Grade A/B and E/U boundaries should be set using professional judgement. The judgement should reflect the quality of candidates' work, informed by the available technical and statistical evidence. Performance descriptions are designed to assist examiners in exercising their professional judgement. They should be interpreted and applied in the context of individual specifications and their associated units. However, performance descriptions are not designed to define the content of specifications and units.

The requirement for all AS and A level specifications to assess candidates' quality of written communication will be met through one or more of the assessment objectives.

The performance descriptions have been produced by the regulatory authorities in collaboration with the awarding bodies

## AS performance descriptions for design and technology

	Assessment Objective 1	Assessment Objective 2
Assessment Objectives	Candidates should demonstrate specific knowledge and understanding and be able to apply that knowledge and understanding in combination with appropriate skills in their designing and should communicate ideas and outcomes and demonstrate strategies for evaluation.	Candidates should be able to demonstrate and apply skills, knowledge and understanding of relevant materials, processes and techniques and use materials and equipment to produce suitable and appropriate outcomes, and should communicate ideas and outcomes and demonstrate strategies for evaluation.
AS A/B boundary Performance Descriptions	<p>Candidates characteristically:</p> <p>a) demonstrate specific knowledge and understanding of the working characteristics of materials, ingredients, components and their uses and/or systems and control</p> <ul style="list-style-type: none"> <li>• develop an appropriate brief and specification</li> <li>• understand quality issues</li> <li>• use correct technical language relevant to the task</li> </ul> <p>b) research and communicate a broad range of ideas and information effectively in a creative and innovative way through some recognition of values issues or uniqueness (for the candidate) or connections with other ideas</p> <ul style="list-style-type: none"> <li>• demonstrate that they understand the main features of industrial and commercial practices related to manufacturing systems including the use of ICT and stages of production</li> <li>• show that they understand health and safety issues through the regulatory and legislative framework</li> </ul> <p>c) demonstrate clear strategies for testing and evaluating by taking into account form and function of a product, trends and styles of products reflecting environmental, cultural and ethical/ moral issues as well as stylistic and engineering considerations</p> <ul style="list-style-type: none"> <li>• analyse and assess information and ideas in appropriate ways, including ICT, enabling others to interpret them.</li> </ul>	<p>Candidates characteristically:</p> <p>a) apply skills that demonstrate understanding of the working characteristics and potential application of a range of materials, ingredients, components and/or systems and control including preparation and processing</p> <ul style="list-style-type: none"> <li>• demonstrate that they understand the principles of testing materials and/or components</li> </ul> <p>b) demonstrate that they understand and can carry out appropriate making processes during product development/manufacture</p> <ul style="list-style-type: none"> <li>• understand and use safe working practices</li> <li>• use appropriate skills in the development of a practical outcome</li> </ul> <p>c) communicate ideas and outcomes</p> <ul style="list-style-type: none"> <li>• refine and/or modify products and/or manufacturing methods</li> <li>• use a range of criteria, for example social, economic, environmental, cultural, and ethical/moral considerations</li> </ul> <p>d) demonstrate clear strategies for testing and evaluating by analysing the planning, production and manufacturing methods.</p>

Assessment Objective 1

Assessment Objective 2

AS E/U boundary  
Performance  
Descriptions

Candidates characteristically:

- a) demonstrate some understanding of how their knowledge and understanding of materials, ingredients, components and their uses meet general design criteria
  - develop an outline brief and specification
- b) communicate ideas and information appropriately
  - demonstrate that they understand at least one feature of industrial and commercial practices, a relevant manufacturing system and some stages of production
- c) demonstrate some strategies for testing and evaluating by taking into account form and function of a product and the need for appropriate modifications.

Candidates characteristically:

- a) demonstrate that they understand the application of a limited range of materials, ingredients and components including their uses
  - demonstrate some knowledge of testing a material or component
- b) demonstrate that they understand and can carry out a limited range of making processes safely during product development
  - demonstrate that they understand how to plan for production
- c) communicate ideas and outcomes through a suitable development process and manufacturing method
  - demonstrate the ability to test and evaluate a limited range of manufacturing methods.

## A2 performance descriptions for design and technology

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	Assessment Objective 1	Assessment Objective 2
Assessment Objectives	Candidates should demonstrate specific knowledge and understanding and be able to apply that knowledge and understanding in combination with appropriate skills in their designing and should communicate ideas and outcomes and demonstrate strategies for evaluation.	Candidates should be able to demonstrate and apply skills, knowledge and understanding of relevant materials, processes and techniques and use materials and equipment to produce suitable and appropriate outcomes, and should communicate ideas and outcomes and demonstrate strategies for evaluation.

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Assessment Objective 1

Assessment Objective 2

AS A/B boundary  
Performance  
Descriptions

Candidates characteristically:

- a) demonstrate specific ability to analyse questions and/or contexts and select and explain relevant ways to proceed during in-depth study
  - take account of a wide range of factors and show knowledge and understanding of materials and manufacturing processes
  - combine distinct elements of technical information in their responses
  - develop an initial design brief, an outline specification and produce a design for manufacturing, considering maintenance and product life
  - clarify the task during designing and making activities identifying a wide range of user needs and carry out in-depth research including some relevant primary research
- b) originate a range of ideas and possible solutions when generating and developing proposals
  - apply knowledge and understanding to develop and refine their solutions, demonstrating evidence of creativity and innovation through recognition of values issues or uniqueness (for the candidate) or connections with other ideas
- c) research, analyse and communicate a broad range of ideas and information effectively
  - use technical language fluently and draw appropriate conclusions

model aspects of their ideas when developing proposals
- d) demonstrate clear strategies for testing and evaluating by taking into account the working characteristics of materials and components; the product's impact on society; and the precise requirements of the brief and/or specification
  - confidently analyse ideas and outcomes and draw highly appropriate conclusions, enhancing interpretation by others.

Candidates characteristically:

- a) demonstrate their understanding of systems and control and/or products and applications by discriminating between aspects of a system or product that perform and those which could be improved after in-depth study
  - demonstrate understanding of reliable and quantifiable performances of a range of materials, components and production processes
  - demonstrate applied knowledge of the working properties and functions of materials and components
  - work safely, accurately and skilfully with materials, components, tools and processes including appropriate technologies to create high-quality products that match the specification
- b) plan, demonstrating an awareness of industrial methods and approaches during designing and making activities
  - select an appropriate range of tools, equipment and plan processes
  - manage time by anticipating potential problems and responding to changing circumstances
  - determine the degree of accuracy required for products to function as intended, and apply relevant external standards to their task
  - test the performance of their product against specified criteria and act on their findings by modifying their proposals if appropriate
- c) communicate ideas and outcomes using ICT appropriately for communicating, modeling, data handling, controlling or manufacture
  - work to devised plans and seek agreement on realistic deadlines
  - take account of the relationship between material, form and manufacturing processes
- d) demonstrate clear strategies for evaluating:
  - analyse information critically and objectively
  - assess the extent to which their work will meet genuine needs
- e) devise quality assurance procedures and reviewing the way the work plan is followed using external sources for evaluating products.

Assessment Objective 1

Assessment Objective 2

AS E/U boundary  
Performance  
Descriptions

Candidates characteristically:

- a) demonstrate their ability to analyse questions and/or contexts and record some relevant information during in-depth study
  - take account of a limited range of factors
  - take account of requirements and demonstrate some knowledge and understanding of manufacturing processes during product analysis
  - develop a design brief and specification
- b) use technical language relevant to the task
  - clarify the task identifying user needs and carry out research during designing and making activities
  - generate ideas based on their own knowledge and understanding, satisfying most of the specification criteria
  - show awareness of manufacturing processes
  - develop their proposals and model at least one aspect
  - indicate at least one working characteristic of a material or component
  - demonstrate some strategies for testing and evaluating that refer to products and the need for modifications
  - evaluate ideas and outcomes in an appropriate way, including ICT, and draw conclusions enabling others to understand them.

Candidates characteristically:

- a) demonstrate a basic understanding of systems and control and/or products and applications during in-depth study
- b) demonstrate some understanding of a limited range of materials, ingredients, components and production processes
- c) work safely with materials, ingredients and components to create a product that meets their specification
- d) plan, demonstrating some awareness of industrial methods during making activities
- e) select some appropriate tools and resources
- f) carry out at least one test of their product
- g) work to an outline plan.
- h) use ICT appropriately for communicating, modelling, data handling, controlling or manufacture
- i) demonstrate strategies for testing and evaluating:
  - analyse information
  - assess the extent to which the product meets its specification.

# Appendix B: Coursework Assessment Criteria for AS F521: *Advanced Innovation Challenge*

NB The Summary Sheet for F521 is for teacher/candidate use only.  
The Unit is externally assessed by OCR

## Session 1

## Marks

1.1 Initial thoughts, design brief and specification	9	
Clearly outlines initial thoughts in detail, responding with an open mind showing unexpected and/or challenging ways of thinking. Analyses problem in depth, responds in a way that allows scope for innovation. Identifies a user/market resulting in a clear design brief. Develops a detailed specification that identifies the key features of the product.	7–9	
Outlines initial thoughts in some detail, some creative thinking. Analyses some aspects of the problem. Identifies a user/market, resulting in a design brief. Develops an adequate specification that gives some basic requirements of the product.	4–6	
Outlines initial thoughts, these are predictable/non-creative. Analyses the problem at a superficial level that lacks depth. Some consideration of a user/market resulting in a design brief. Produces a basic or superficial specification that is vague/generic.	0–3	
1.2 Designing	12	
Presents a wide range of innovative/creative initial ideas, using high quality annotated sketching showing full details of construction/materials. Presents a wide range of evidence to show the sources of inspiration and influences on the designing. Presents a detailed and objective evaluation of ideas against the design specification and justifies all decisions. Reflects on their chosen design and responds to feedback from others, making further improvements if necessary.	9–12	
Presents a good range of innovative/creative ideas using reasonable quality annotated sketching showing some detail of construction/materials. Presents an adequate range of evidence to show the sources of inspiration and influences on the designing. Presents an adequate and objective evaluation of ideas against the design specification and justifies most decisions. Some reflection on their chosen design and response to feedback from others.	5–8	
Presents only a limited range of innovative/creative ideas using annotated sketching at a limited level with little detail of construction/materials. Little or no reference made to the design specification. Presents a limited range of evidence to show the sources of inspiration and influences on the designing. Presents only a limited and mainly subjective evaluation of ideas with little or no justification of decisions. Limited reflection on their design and little/if any response to feedback from others.	0–4	



1.3 Development and planning		9
Presents improvements, presents evidence of modelling, experiments, testing, making modifications to their design to define and refine it, thorough consideration of materials, components or ingredients and methods of manufacture. Produces a detailed action plan for making, to include a list of materials/ingredients/resources, etc.	7–9	
Presents improvements, presents some evidence of modelling, experiments, testing, making modifications their design, some consideration of materials, components or ingredients and methods of manufacture. Some consideration of sustainability issues. Produces a reasonable action plan for making, to include a list of materials/ingredients/resources, etc	4–6	
Presents limited improvements, and limited evidence of modelling, experiments, testing, and modifications to their design, little if any consideration of materials, components or ingredients and methods of manufacture. Limited understanding of sustainability issues and how this affects their design. Produces a simplistic action plan for making that shows limited awareness of materials/ingredients/resources etc.	0–3	

**Total**

<b>30</b>	
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## Session 2

**Marks**

2.1 Making		22
Records and reflects on progress in detail at various stages. Selects and uses materials innovatively and creatively and further develops idea to define and refine it. Completes a product/model to a high standard. Demonstrates a range of making skills/ and or complexity.	17–22	
Record and reflects on progress at various stages. Selects and uses materials adeptly and makes further modifications to their design. Completes a product/model to a good standard, demonstrates accuracy of making skills. Model/product accurately reflects design.	9–16	
Records progress at various stages but limited detail and thought. Use of materials and processes is limited as are any further modifications to their design. Product/model is finished to a poor standard/or is incomplete. Limited range of making skills apparent.	0–8	

## 2.2 Evaluation

**8**

Presents realistic and detailed modifications to their idea, using annotated sketches; improvements are creative. Produces a detailed evaluation of their product identifying strengths and weaknesses and shows good consideration of the users/market. Evaluates their design thoroughly against their product specification.	6–8	
Presents some realistic and detailed modifications to their idea, using annotated sketches. Produces a reasonable evaluation of their product identifying some strengths and weaknesses and shows good consideration of the users/market. Reasonable evaluation of their design against their product specification.	4–5	
Presents limited modifications to their idea, using basic annotated sketches. Produces a limited evaluation of their product identifying some strengths and weaknesses and shows limited consideration of the users/market. Some evidence of evaluation of their design against their product specification at a superficial level.	0–3	

Session 3 is the written question paper

**Total**

<b>30</b>	
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# Appendix C: Coursework Assessment Criteria for AS F522: *Product Study*

	<b>Marks</b>	
<b>Product focus and analysis</b>	<b>8</b>	
Clearly identifies a suitable specific single product with a focus, gives a detailed description of the intended purpose of the product, including the needs of both the manufacturer and the consumer and identifies a wide list of criteria used in the designing of the original product.	6-8	
Identifies a specific single product with a focus, gives some detail of the intended purpose of the product, including some reference to the needs of both the manufacturer and the consumer and identifies the more obvious criteria used in the design of the original product.	4-5	
Identifies a product, shows only limited awareness of the intended purpose of the product, referring only to the more obvious aspects. Little or no awareness of the needs of the manufacturer and consumer. Identifies few or no criteria used in the design of the original product with little evidence of understanding.	0-3	
<b>Strengths and weaknesses comparison</b>	<b>12</b>	
Presents a detailed analysis of the strengths and weaknesses of the single selected product, in comparison to a range of similar products, in terms of function, suitability of materials, components or ingredients and manufacturing processes used, ergonomic suitability, aesthetics and cost. Shows clear understanding.	11-12	
Presents a reasonably detailed analysis of the strengths and weaknesses of the product, in comparison to a limited range of similar products, in terms of function, suitability of materials, components or ingredients and manufacturing processes used, ergonomic suitability, aesthetics and cost. Shows reasonable understanding of the more obvious issues.	6-10	
Limited ability to analyse or identify the strengths and weaknesses of the product, with little or no comparison to other similar products, in terms of function, suitability of materials, components or ingredients and manufacturing processes used, ergonomic suitability, aesthetics and cost. Shows only limited understanding of these factors.	0-5	
<b>Moral implications</b>	<b>8</b>	
Demonstrates clear understanding of the influences of relevant moral implications on the design and use of the product.	6-8	
Shows some understanding of the more obvious moral implications and identifies some of their influences on the design of the product.	4-5	
Shows little or no understanding of relevant moral implications and is unable to identify their influence on the design of the product.	0-3	
<b>Brief and specification for improving the product</b>	<b>8</b>	
Presents a detailed design brief for improving the product in some way. Produces a detailed and justified specification from the objective analysis of the original product.	6-8	
Presents a clear design brief, which shows reasonable awareness of possible improvements. Produces an adequate specification covering a range of issues. Justification is fair and is based on some objective analysis of the original product.	4-5	
Presents only a simplistic brief with little depth concerning possible improvements. Produces only a basic or superficial specification. Justification is minimal showing little evidence of objective analysis of the original product.	0-3	

<b>Development of improvement</b>	<b>56</b>	
Presents a wide range of innovative/creative initial ideas, which demonstrate a high level of development using high quality annotated sketching, real-time digital images and interactive dialogue. Makes a wide range of appropriate prototype models. Presents a detailed and objective evaluation of ideas against the design specification in real time and justifies all decisions.	44–56	
Presents a good range of innovative/creative ideas with varying levels of development using reasonable quality annotated sketching, digital images and interactive dialogue. Makes a good range of appropriate prototype models. Presents an adequate and objective evaluation of ideas against the design specification in real time and justifies most decisions.	24–43	
Presents only a limited range of innovative/creative ideas, which are developed only to a simplistic level or not at all using annotated sketching at a limited level. Makes a more limited range of moderate prototype models. Presents only a limited and mainly subjective evaluation of ideas with little or no justification of decisions. Little or no reference made to the design specification.	0–23	
<b>Testing of final developed idea</b>	<b>12</b>	
Plans and implements an appropriate method or system to formally test and evaluate their final developed idea, or the suitability of the proposed materials, components or ingredients. Real-time results are presented clearly and concisely.	11-12	
Plans and implements a reasonable method or system to formally test and evaluate their final developed idea, or the suitability of the proposed materials, components or ingredients. Real-time results are presented reasonable clearly and concisely.	6-10	
Plans and implements a more limited method or system to formally test and evaluate their final developed idea, or the suitability of the proposed materials, components or ingredients. Results are poorly presented and inconclusive.	0-5	
<b>Summary of results</b>	<b>8</b>	
Produces an objective summary of the results of the product development with detailed analysis of how the prototypes and final tests contributed to establishing the validity of the chosen idea. Results are presented in detail and their value analysed thoroughly. One further improvement is suggested and presented in detail.	6-8	
Produces an efficient summary of the results of the product development with reasonable analysis of how the prototypes and final tests contributed to establishing the validity of the chosen idea. Results are presented carefully and their value analysed to a reasonable level. One further improvement is suggested and presented in reasonable detail.	4-5	
Produces a subjective summary of the results of the product development with limited or no analysis of how the prototypes and final tests contributed to establishing the validity of the chosen idea. Results are presented at a superficial level with little analysis. One further improvement is suggested but is presented with little or no detail.	0-3	
<b>Communication</b>	<b>8</b>	
Uses a wide range of high quality text, graphical techniques, digital technology, and interactive dialogue as appropriate to present information.	6-8	
Uses a good range of quality text, graphical techniques, digital technology, and interactive dialogue as appropriate to present information.	4-5	
Shows a limited range of text, graphical techniques and digital technology, to present information.	0-3	
<b>Total</b>	<b>120</b>	

# Appendix D: Coursework Assessment Criteria for A2 F523: *Design, Make and Evaluate*

	<b>Marks</b>
<b>Design brief</b>	<b>3</b>
Presents a clear and precise design brief for a marketable product.	3
Presents a reasonable design brief for a marketable product.	2
Presents a superficial design brief for a marketable product.	0–1
<b>Information, inspiration and influences</b>	<b>9</b>
Obtains all significant information relevant to the design of the product. Presents a wide range of evidence to show the sources of inspiration and influences on the designing.	7–9
Obtains some information relevant to the design of the product. Presents an adequate range of evidence to show the sources of inspiration and influences on the designing.	5–6
Obtains limited information relevant to the design of the product. Presents a limited range of evidence to show the sources of inspiration and influences on the designing.	0–4
<b>Design specification</b>	<b>3</b>
Produces a detailed design specification. Design requirements are justified objectively.	3
Produces an adequate design specification. Design requirements are justified adequately.	2
Produces a superficial design specification. Design requirements are justified subjectively.	1
<b>Design, design development and making</b>	
Candidates should be able to: <ul style="list-style-type: none"> <li>• demonstrate competence in the design, design development and making of the product. The package of evidence to include the following: <ol style="list-style-type: none"> <li>1. the generation and exploration of design possibilities;</li> <li>2. the use of digital technologies;</li> <li>3. experimenting and modelling;</li> <li>4. the refining and defining of a final design through ongoing evaluation;</li> <li>5. the planning and making of the product.</li> </ol> </li> </ul> <p>Further exemplification of these strands can be found in Appendix E.</p>	

Design, design development and making	<b>Design, design development and making</b>	<b>57</b>	
		49–57	
		41-48	
		33-40	
		24-32	
		11–23	
		0–10	
	<b>Innovation</b>	<b>15</b>	
	The designing/making shows clear evidence of innovation in both solutions and methods.	12–15	
	The designing/making shows some evidence of innovation and creativity.	7–11	
	The designing/making shows little or no evidence of innovation and originality.	0–6	
	<b>Testing and independent evaluation of the final product</b>	<b>9</b>	
	Shows evidence of thorough testing of the final product against these specifications. Identifies and clearly states the strengths and weaknesses in the product. Responds positively to in depth independent evaluation of the product.	7–9	
	Shows reasonable evidence of testing of the final product against these specifications. Identifies some strengths and weaknesses in the product. Shows a reasonable response to some independent evaluation of the product.	5–6	
	Shows limited or no evidence of testing of the final product against these specifications. Identifies few strengths and weaknesses in the product. Shows a superficial response to limited independent evaluation of the product.	0–4	
	<b>Marketing presentation</b>	<b>15</b>	
	Creates a competent marketing presentation suitable for the final product.	12–15	
	Creates an adequate marketing presentation suitable for the final product.	7–11	
	Creates a weak marketing presentation for the final product.	0–6	
<b>Review and reflection</b>	<b>9</b>		
Presents a thorough and detailed review and reflection of the effectiveness of the designing and making process that led to the final product. Considers in detail the possible wider implications and impact of the product, including clear details of possible future developments.	7–9		
Presents an adequate review and reflection of the effectiveness of the designing and making process that led to the final product. Considers in reasonable detail the possible wider implications and impact of the product, with some details of possible future developments.	5–6		
Presents a superficial review and reflection of the effectiveness of the designing and making process that led to the final product. Considers in limited detail the possible wider implications and impact of the product, with few details of possible future developments.	0–4		
<b>Total</b>	<b>120</b>		

# Appendix E: Coursework Assessment Criteria for A2 F523: *Design, Make and Evaluate* Section 4a

49-57	<ul style="list-style-type: none"> <li>Shows significant depth and/or breadth in designing and making skills involving complexity and a very high level of intellectual challenge and difficulty. The design development is technically advanced with a high level of detail. There is an intuitive, well-structured, thorough, and logical approach is clearly evident throughout. Presentation is in real time, and is relevant, extremely clear and coherent.</li> <li>Very broad and creative exploration of a wide range of design possibilities. Detailed, descriptive, and evaluative annotation shows a highly perceptive awareness of user needs, commercial manufacturing, and marketing issues and relevant references to wider issues such as sustainability and moral issues.</li> <li>Extensive and expert use of sophisticated digital technology throughout, including, where relevant, CAD and CAM, digital photography, audio and video, image manipulation, design analysis and simulation software.</li> <li>An extensive range and variety of purposeful models and experiments aid design origination and development, and very clear progression to a fully refined design solution.</li> <li>Objective ongoing evaluation against the Design Specification and regular consultations with the client / user / target market lead to a clearly and fully defined design solution containing full technical details for third party manufacture without any further guidance required.</li> <li>Detailed forward planning is clearly evident and all key stages for manufacture are identified in advance. A complete and fit-for-purpose product involving a range of hand, machine and CAM processes shows exceptional attention to quality, detail and finish.</li> </ul>
41-48	<ul style="list-style-type: none"> <li>Shows a very good depth and/or breadth in designing and making skills, involving some level of complexity and a very good level of intellectual challenge and difficulty. The design development is technically strong with very good detail. A well-structured, thorough, and logical approach is evident throughout. Presentation is mostly in real time, and is relevant, clear and focused.</li> <li>Creative exploration of a wide range of design possibilities. Descriptive and evaluative annotation shows a perceptive awareness of user needs, commercial manufacturing, and marketing issues and relevant references to wider issues such as sustainability.</li> <li>Effective and appropriate use of digital technology throughout, including, where relevant, CAD and CAM, digital photography, audio and video, image manipulation, design analysis and simulation software.</li> <li>A wide range of effective models and experiments aid design origination and development, and clear progression to a refined design solution.</li> <li>Detailed ongoing evaluation against the Design Specification and regular consultations with the client / user / target market lead to a clearly defined design solution containing a good level of technical detail for third party manufacture with little further guidance required.</li> <li>Forward planning is evident and key stages for manufacture are identified in advance. A complete and suitable product involving a wide range of processes shows very good attention to quality, detail and finish.</li> </ul>
33-40	<ul style="list-style-type: none"> <li>There is good depth and/or breadth in designing and making skills, involving some level of complexity and a good level of intellectual challenge and difficulty. The design development includes a good level of detail. A sound, organised and sensible approach is evident throughout; Presentation is generally relevant and clear.</li> <li>Good exploration of a range of design possibilities, with some creativity shown. Descriptive and evaluative annotation with reference to user needs, commercial manufacturing, and marketing issues, and there are some relevant references to wider issues such as sustainability.</li> <li>Appropriate use of digital technology, including, where relevant, CAD and CAM, digital photography, audio and video, image manipulation, design analysis and simulation software.</li> <li>A range of models and experiments aid design development, and sound progression to a final design solution.</li> <li>Sound evaluation with reference to the Design Specification and consultations with the client / user / target market lead to a reasonable definition of the final design solution. Aspects of the final design definition contain sufficient detail for third party manufacture.</li> <li>Sound evidence of advance planning for most of the stages of making. A complete and largely suitable product involving a range of processes shows good attention to detail and finish.</li> </ul>

24-32	<ul style="list-style-type: none"> <li>• There is reasonable depth and/or breadth in designing and making skills, with some aspects of the work involving reasonable intellectual challenge and difficulty. Aspects of the design development include some detail. A straightforward approach is evident. Presentation is reasonable and relevant in some aspects of the work.</li> <li>• Some exploration of a range of design possibilities. Some evaluative annotation with basic consideration of user needs, consideration of commercial manufacturing, and marketing issues, and there are generic references to wider issues such as sustainability.</li> <li>• Some use of digital technology, including, where relevant, CAD and CAM, digital photography, audio and video. Some basic use of image manipulation, design analysis and simulation software.</li> <li>• A range of models and experiments aid design development, and some progression towards a final design solution.</li> <li>• Some reference to the Design Specification and the client / target market during the design development. A final design is identified with some technical detail, suitable for third party manufacture with some further guidance.</li> <li>• Advance planning for some stages of making. A partially complete or partially suitable product shows reasonable care and attention to detail and finish.</li> </ul>
11-23	<ul style="list-style-type: none"> <li>• There is limited depth and/or breadth in designing and making skills. The work is superficial, involving a low level of intellectual challenge and difficulty. The designing contains limited detail. A disorganised approach is evident. Presentation is retrospective with limited relevance, clarity and coherence.</li> <li>• A narrow range of design possibilities, little exploration. Some descriptive annotation, generic comments, and simplistic and obvious consideration of user needs, obvious commercial and marketing issues, and there are limited references to wider issues such as sustainability.</li> <li>• Superficial and basic use of digital technology, little CAD or CAM, digital photography or use of or reference to specialist software applications and functions.</li> <li>• Limited experimentation and modelling with limited value or purpose, and limited progression and development towards a final design solution.</li> <li>• Limited reference to the Design Specification and the client / target market during the design development. A poorly defined final design with limited detail. Limited detail for third party manufacture.</li> <li>• Limited advance planning for making. An incomplete or unsuitable product shows limited care and attention to detail and finish.</li> </ul>
1-10	<ul style="list-style-type: none"> <li>• There is a narrow range of designing and making skills. The work is very simplistic. The designing is minimal and unclear. A random approach is evident. Presentation is incoherent and inappropriate.</li> <li>• One design possibility is presented with minimal annotation or relevant comment. There is minimal consideration of user needs, commercial and marketing issues, or wider issues such as sustainability.</li> <li>• Minimal use of digital technology or reference to specialist software applications and functions.</li> <li>• Minimal experimentation or modelling. A disorganised approach with minimal progression and development towards a final design solution.</li> <li>• Minimal reference to the Design Specification or the client / target market during the design development. Any details of a final design are presented with insufficient information for third party manufacture.</li> <li>• A retrospective record of planning for making. An unsuitable product shows poor detail and finish.</li> </ul>

0 marks = no response or no response worthy of credit.