

# **Design and Technology**

## **Innovator Suite**

OCR GCSE in Design and Technology: Electronics and Control Systems J301

OCR GCSE (Short Course) in Design and Technology: Electronics and Control Systems J041

**July 2009**

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Vertical black lines indicate a significant change to the previous printed version. Changes can be found on pages 12, 49 and 50.

# 1 About these Qualifications

This booklet contains OCR's GCSE (Short Course) and GCSE specification in Design and Technology: Electronics and Control Systems for teaching from September 2009.

This fresh approach to GCSE Design and Technology: Electronics and Control Systems reflects the status of the subject within the National Curriculum and the positive effects of the Key Stage 3 initiative now working its way through to KS4.

This specification provides an innovative and imaginative qualification, rewarding flair and reflecting the contemporary use of information technology (ICT). One key element of this specification is to encourage candidates to recognise the contribution they can make to the environment through careful consideration and selection of sustainable resources.

The format of this specification allows candidates to approach the course in a variety of ways. Being unitised, activities can be organised to run in harmony with the design and technology department making best use of the resources available. Candidates can follow a traditional approach to the course, entering for all the units at the end of their course, or they can be entered for individual units in any January and June session (see Section 6: Technical Information).

This specification encourages candidates to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study. Specifically candidates will actively:

- Be engaged in the processes of design and technology in order to develop as effective and independent candidates.
- Be involved in making decisions, consider sustainability and combine skills with knowledge and understanding in order to design and make quality products
- Explore ways in which aesthetic, technical, economic, environmental, ethical and social dimensions interact to shape designing and making
- Analyse existing products and produce practical solutions to needs, wants and opportunities, recognising their impact on quality of life
- Develop decision-making skills through individual and collaborative working
- Understand that designing and making reflect and influence cultures and societies, and that products have an impact on lifestyle
- Develop skills of creativity and critical analysis through making links between the principles of good design, existing solutions and technological knowledge.

This specification contains two Controlled Assessment units for which evidence can be submitted electronically via the OCR Repository (See Section 6.13).

This specification covers systems and control in Electronics, Pneumatics and Mechanisms. Units A511, A512 and A513 can be studied in any one of these according to the candidate's and centre's preferences. Candidates sitting Unit A514 must enter for either Electronics, Pneumatics or Mechanisms, each paper contains only questions relating to that area.

## 1.1 GCSE (Full Course)

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From September 2009 the GCSE is made up of **four** mandatory units. These consist of the **two** corresponding GCSE (Short Course) units, forming 50% of the overall full-course assessment, and **two** further units, one of which is internally assessed and forms 30% of the overall assessment and the other is externally assessed and forms 20% of the overall assessment.

## 1.2 GCSE (Short Course)

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The GCSE (Short Course) is both a 'stand-alone' qualification and also the first half of the corresponding GCSE. The GCSE (Short Course) is assessed at the same standard as the corresponding two-year GCSE course.

From September 2009 the GCSE (Short Course) is made up of **two** mandatory units, one of which is internally assessed and forms 60% of the overall assessment and the other is externally assessed and forms 40% of overall assessment. These units correspond to two units of the GCSE (Full Course) and thus allow co-teachability and flexibility in scheduling and timetabling.

## 1.3 Qualification Titles and Levels

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These qualifications are shown on a certificate as:

- OCR GCSE in Design and Technology: Electronics and Control Systems
- OCR GCSE (Short Course) in Design and Technology: Electronics and Control Systems.

These qualifications are approved by the regulatory authorities (QCA, DCELLS and CCEA) as part of the National Qualifications Framework.

Candidates who gain Grades D to G will have achieved an award at Foundation Level 1 (Level 1 of the National Qualifications Framework).

Candidates who gain Grades A\* to C will have achieved an award at Intermediate Level 2 (Level 2 of the National Qualifications Framework).

## 1.4 Aims and Learning Outcomes

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GCSE specifications in design and technology should encourage candidates to be inspired, motivated and challenged by following a broad, coherent, satisfying and worthwhile course of study, and to gain an insight into related sectors, such as manufacturing and engineering. They should prepare candidates to make informed decisions about further learning opportunities and career choices.

GCSE specifications in design and technology must enable candidates to:

- Engage actively in the processes of design and technology to develop into effective and independent learners
- Make decisions, consider sustainability and combine skills with knowledge and understanding in order to design and make quality products
- Explore ways in which aesthetic, technical, economic, environmental, ethical and social dimensions interact to shape designing and making
- Analyse existing products and produce practical solutions to needs, wants and opportunities, recognising their impact on quality of life
- Develop decision-making skills through individual and collaborative working
- Understand that designing and making reflect and influence cultures and societies, and that products have an impact on lifestyle
- Develop skills of creativity and critical analysis through making links between the principles of good design, existing solutions and technological knowledge.

## 1.5 Prior Learning/Attainment

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Candidates who are taking courses leading to this qualification at Key Stage 4 should normally have followed the corresponding Key Stage 3 Programme of Study within the National Curriculum.

## 2 Summary of Content

### Outline of Concept

This fresh approach to GCSE Design and Technology: Electronics and Control Systems reflects the status of the subject within the National Curriculum and the positive effects of the Key Stage 3 initiative now working its way through to KS4.

This specification provides an innovative and imaginative qualification rewarding flair and imagination and reflecting the contemporary use of materials and Information Technology. One key element of this specification is to encourage candidates to recognise the contribution they can make to the environment through careful consideration and selection of sustainable resources.

The specification, which is one of six specifications making up the OCR Innovator suite of GCSE Design and Technology qualifications aims to provide a challenging yet very rewarding course for candidates and teachers alike.

In both the Full and Short Course, candidates have the opportunity to work with design concepts and materials in ways which recognise the need for wise choices being made in terms of the environment and the whole social fabric of life.

Taught as a suite of qualifications, there are opportunities for efficient use of both human and physical resources. Teachers can be confident in the knowledge that they are part of a team preparing candidates for a common goal.

This particular specification aims to promote the careful and thoughtful use of electronic, mechanical or pneumatic control systems as appropriate to a situation, along with their associated components.

## 2.1 GCSE Units

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### Unit A511: *Introduction to designing and making*

- Developing research and investigation skills
- Developing drawing skills
- Modelling
- Evaluating process

### Unit A512: *Sustainable design*

- Consideration of products
- Consideration of the environment
- Consideration of society and the economy

### Unit A513: *Making quality products*

- Designing for a need
- Working with tools and equipment
- Evaluating the product

### Unit A514: *Technical aspects of designing and making*

- Working with tools, materials and components
  - Selecting processes
  - Designing for success
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## 2.2 GCSE (Short Course) Units

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### Unit A511: *Introduction to designing and making*

- Developing research and investigation skills
- Developing drawing skills
- Modelling
- Evaluating process

### Unit A512: *Sustainable design*

- Consideration of products
  - Consideration of the environment
  - Consideration of society and the economy
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# 3 Content

## 3.1 Unit A511: *Introduction to designing and making*

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This unit aims to give candidates an introduction to designing and making using control systems.

Candidates must select one of the published themes (see Appendix C) as a starting point for this coursework unit. Once a theme is selected, the candidate will then need to identify a specific existing product or starting point that is associated with the theme. For example, if the chosen theme is 'Travel' a candidate may decide to design and model a hand-held game which can be used 'on the move'.

Candidates undertake research associated with the specific product before establishing their own design brief and detailed specification for an improved or similarly functioning prototype\*. They develop their design and use modelling before making and testing their prototype\* and evaluating the making process. Throughout the process, the candidate will record research and design developments using a portfolio to include photographs and other digital media. In the design process, candidates must use the systems approach, clearly showing Input–Process–Output.

In order to design and model their prototype\* skilfully, candidates should use the designing, planning and modelling skills, materials, tools, equipment and processes that are appropriate to working in control systems.

This unit is a Controlled Assessment unit. For further details see Section 5.

\*In this context a prototype is defined as the first example of a product that could be further developed or modified.

### **Candidates will be required and assessed on their ability to:**

- |                              |   |
|------------------------------|---|
| Demonstrate Creativity       | <ul style="list-style-type: none"><li>• Use appropriate recording and drawing techniques including the use of ICT</li><li>• Identify complex associations linking principles of good design and technological knowledge</li><li>• Identify trends in existing products and fully evaluate them against the needs of the intended user.</li></ul>  |
| Demonstrate Designing Skills | <ul style="list-style-type: none"><li>• Produce an appropriate and considered response to a design brief</li><li>• Produce a detailed specification for the prototype</li><li>• Use detailed notes and annotated drawings to record original design ideas</li><li>• Use appropriate making or trialling techniques to aid product development</li><li>• Use CAD to support design development</li><li>• Make reasoned decisions about materials / components.</li></ul> |
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Demonstrate Good Making Skills

- Plan and organise activities
- Select appropriate materials / components
- Select appropriate equipment
- Work skilfully and safely to shape, and form finish materials and assemble components
- Complete a quality prototype
- Apply knowledge of control systems, digital media and new technologies as appropriate
- Demonstrate a practical and thorough understanding and ability in solving technical problems effectively and efficiently as they arrive
- Record key stages in the making of the product

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Demonstrate Critical Evaluation Skills

- Evaluate the processes involved in making the final prototype\*
  - Reflect on the evaluation and suggest modifications to improve the making process.
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## 3.2 Unit A512: Sustainable design

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This unit aims to develop a candidate's knowledge and understanding of sustainability, environmental concerns, and cultural, moral and social issues. Candidates will look at how design and technology has evolved through examination of products from the past and present. Candidates need to consider how future designs will impact on the world in which we live. Candidates will need to study examples of both old and new products in order that they might gain awareness and understanding of trends and innovations in design and manufacture, labelling, packaging and the impact that the design of such products is having on the environment, society and the economy.

Moral, cultural, economic, environmental and sustainability issues are inherent in design and technology. Within the commercial context, the product life cycle, choice and use of materials, planned obsolescence and eventual disposal of products are of paramount importance.

Working with the selected control system, candidates should develop knowledge and understanding of the subject content listed below.

The assessment of this unit is through an externally set and marked test.

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### The 6Rs

#### Recycle

- Materials that can be recycled – primary, secondary, tertiary
  - Products that use recycled materials
  - Disassembly- reprocessing materials for use in new products
- 

#### Reuse

- Products that can be reused for either the same purpose or a new purpose
  - Products that can be adapted to suit an alternative use
- 

#### Reduce:

- Life cycle of product(s)/Eco Footprint
  - Built in obsolescence
  - Energy and waste of production process
  - Materials – waste.
- 

#### Refuse:

- Issues relating to sustainable design
  - Materials we should refuse to use.
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#### Rethink:

- How it is possible to approach design problems differently
  - An existing product that has become waste, eg utilising materials or components for another purpose without processing it.
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#### Repair:

- Products that can be repaired and consider issues of repair.
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## Product analysis and the design of products

### Social issues:

- Social development, through recognising the need to consider the views of others including people with disabilities when designing and discussing designed products
- Signs and symbols giving valuable information about materials, products and safety issues.
- Anthropometrics and ergonomics

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### Moral issues:

- Conditions of working
- Protecting the safety of users of products
- Ethical trading initiative (ETI).

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### Cultural issues:

- Looking at, responding to and valuing the responses of others to design solutions
- The impact of different cultures on modern products.

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### Environmental issues:

- Understanding and being able to select materials, including 'smart' and 'modern' materials that are both suitable and sustainable
- The reduction in the common use of chemicals and materials dangerous to the environment, ie bleaches, CFCs, toxic materials
- Carbon footprint – transportation of materials and goods, energy usage in manufacture
- Carbon offsetting
- The need to dispose of redundant products and their packaging in a safe and environmentally friendly way.

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### Design issues:

- Identifying how good design and product choice improves the quality of life
  - Examining the way that designers respond to changing styles, taste, technological advances, and environmental pressures
  - Eco-design – the whole system of looking at a product from design to finished article, its use of materials and energy
  - The globalisation of products.
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## Delivery of the unit

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This unit should be delivered through a number of mini-tasks. These tasks will vary in nature, some will be based around group discussion, others will involve the candidate working with ideas and media, researching concepts and recording information. Activities may also involve visits to particular Technology Innovation centres, industry, local councils, museums, etc.

Evidence could be collected and recorded in the form of a research report (not assessed), which can be used at the end of the unit for examination preparation.

### 3.3 Unit A513: *Making quality products*

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In this Unit candidates will be expected to further develop skills and abilities gained while undertaking Unit A511 in order to design and make a fully functioning quality product. The type of project selected needs to be challenging but realistic in terms of the resources and time available. Candidates should be encouraged to consider their own needs/requirements or that of an identified user group as well as the situation in which the product will be used.

Candidates will be required to consider the focus of the design brief before developing a design specification. Candidates need to demonstrate their ability to plan, to develop creative and original design ideas and to carry out a range of practical activities.

Candidates will be expected to critically evaluate their ideas against the design specification to identify, with reasons, the chosen design proposal for product development. As a result of product development candidates will be expected to give reasoned decisions for the materials, components and equipment required for the production of the final product. Throughout the task the candidate will record research and design developments using a portfolio to include photographs and other digital media. In the design process candidates must use the systems approach clearly showing Input Process and Output.

Candidates will be expected to test and critically evaluate their final product against a product specification.

This unit is a controlled assessment unit. See section 5 for further details.

#### **Candidates will be required and assessed on their ability to:**

Develop and demonstrate designing skills

- Use appropriate recording and drawing techniques
- Identify complex associations linking principles of good design and technological knowledge
- Produce an appropriate and considered response to a design brief
- Produce a detailed specification for the product
- Use detailed notes and annotated drawings (where appropriate) to record original design ideas
- Use appropriate modelling or trialling techniques to aid product development
- Use ICT/CAD/CAM to support design development
- Apply knowledge of digital media and new technologies as appropriate
- Use drawing and annotation to communicate clearly details of the design chosen for prototype production.

Demonstrate good making/workshop skills

- Plan, organise and record key manufacturing activities by means of comprehensive notes and photographic evidence
- Make reasoned decisions about materials/components
- Select appropriate materials/components
- Select appropriate tools and equipment
- Work skilfully and safely to shape, form, finish materials and assemble components
- Apply knowledge of production systems, ICT and new technologies as appropriate
- Finish the product to a high-quality standard
- Demonstrate a practical and thorough understanding and ability in solving technical problems effectively and efficiently as they arise.

Demonstrate critical evaluation skills

- Evaluate the product against the specification
- Undertake detailed testing and present meaningful conclusions.

### 3.4 Unit A514: *Technical aspects of designing and making*

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This unit focuses on the knowledge, skills and understanding underpinning the design and manufacture of products made using control systems.

The assessment of this unit is through an externally set and externally marked test.

There will be three question papers, one each for electronics, mechanisms and pneumatics.

Candidates will only answer questions from one paper.

Each paper will contain two sections. Section one will have three questions assessing candidates' knowledge of control systems in their respective discipline: electronics/mechanisms/pneumatics. Section two will have two questions giving opportunities for candidates to show design thinking in their respective discipline: electronics/mechanisms/pneumatics.

Candidates will need a knowledge and understanding of:

- Designing and making quality manufactured products
- Planning production with consideration of the use of time and resources
- Performance characteristics of different materials, including 'smart' and modern materials
- The impact of emerging technologies on designers and consumers
- Tools and equipment, including new technologies, used to make quality manufactured products
- Processes and techniques used to make quality manufactured products, both decorative and functional
- The impact that the use of the selected control system has on the environment, including the need to consider sustainability
- Health and safety issues.

## Materials for control systems

		Electronics	Mechanisms	Pneumatics
General classification	• Metals and plastics in common use in school workshops and the manufacturing industry	✓	✓	✓
	• Timber composites and manufactured board		✓	
	• Availability and selection of appropriate specific materials for particular applications in one-off and quantity production	✓	✓	✓
	• Market forms of materials; standard shapes and sizes of metal sections; sheet, powder and granular plastics		✓	
Performance characteristics	• Properties and applications of metals and alloys – including steel, brass, copper, aluminium alloys		✓	✓
	• Properties and applications of thermoplastics – including ABS, polystyrene, PVC, nylon, acrylic	✓	✓	✓
	• Properties and applications of thermosetting plastics – including GRP, PCB substrate, epoxy adhesive	✓		
	• Properties and applications of timber composites – including plywood, particle board		✓	
Finishing processes	• Labelling	✓		
	• Protection from the working environment	✓	✓	✓
	• Protection from wear in use		✓	✓
'Smart' and modern materials	• Including – QTC, memory metals; properties and typical applications	✓	✓	✓
	• Awareness of other 'smart' and modern materials as they become available	✓	✓	✓
Properties of materials	• Physical properties when selecting for a specific use	✓	✓	✓
	• Aesthetic qualities of materials	✓	✓	✓
	• Cultural, moral and sustainability issues when choosing materials	✓	✓	✓
	• Cost implications	✓	✓	✓
Environmental issues	• Impact of production, use and disposal of materials	✓	✓	✓
Pre-manufactured components	• Components needed in the manufacture of a product	✓	✓	✓
	• Identify and suggest an application for a wide range of pre-manufactured components	✓	✓	✓
Mechanical properties	• Tension, compression, torsion, shear, bending		✓	✓
Structural properties	• Ductility, plasticity, hardness		✓	✓

## Materials for control systems (continued)

		Electronics	Mechanisms	Pneumatics
Conductive properties	<ul style="list-style-type: none"> <li>Thermal, electrical</li> </ul>	✓	✓	✓
Health and safety	<ul style="list-style-type: none"> <li>COSHH regulations relating to materials</li> </ul>	✓	✓	✓
Nanotechnology	<ul style="list-style-type: none"> <li>Define nanotechnology as the manipulation of atoms</li> </ul>	✓	✓	✓
Nanomaterials	<ul style="list-style-type: none"> <li>Nanowires, carbon nanotubes as semiconductors; manufacture of transistors and capacitors</li> </ul>	✓	✓	
Health and safety issues	<ul style="list-style-type: none"> <li>Awareness of potential risks, eg particles of nanomaterial entering the bloodstream</li> </ul>	✓	✓	✓
Radio Frequency Identification (RFID)	<ul style="list-style-type: none"> <li>Physical characteristics, active and passive devices, operating frequencies, range of readers</li> </ul>	✓	✓	✓
Applications	<ul style="list-style-type: none"> <li>Uses as a replacement for bar codes, stock control, inventories, toll pass cards, clothing</li> </ul>	✓	✓	✓
Moral and ethical issues	<ul style="list-style-type: none"> <li>Ability to track consumers by use of an RFID tag embedded in an item that has been purchased; use of 'kill software' to deactivate the tag</li> </ul>	✓	✓	✓
Printable circuits	<ul style="list-style-type: none"> <li>Printing circuits using inkjet technology, printable transistors using carbon nanotubes; comparison to traditional subtractive circuit production methods.</li> </ul>	✓		

## Design

- Generate and record a range of innovative design solutions for a specific task/user need
- Evaluate and modify ideas with consideration of creativity and sustainability
- Consider the initial task, the need to be met, function and aesthetics
- Develop and model design proposals
- Justify choice and rejection of ideas
- Select and justify materials when designing and making products
- Use a range of skills to communicate ideas including graphic techniques, ICT including CAD and digital technologies
- Understand the purpose of prototyping when designing and making products
- Identify a variety of methods used when prototyping, including breadboard, CAD simulation, use of systems approach
- Understand the principles of anthropometrics and ergonomics when designing and making products
- Identify specific ergonomic requirements within a product and apply anthropometric data when designing and making products.



## Product planning

- Produce a detailed plan for making that includes information on:
  - Materials and manufactured items
  - Tools and equipment
  - Processes
  - Health and Safety
  - Time schedules
- Choose and prepare materials economically, considering cost, sustainability, environmental, moral and cultural issues
- Plan work to make best use of materials, components, equipment and resources, including time and energy
- Be aware of problems that arise during production and have strategies to overcome them.

## Tools and equipment

- Knowledge and understanding of the basic equipment for Control Systems; how to select the appropriate tool and use it safely and effectively.
- Awareness of alternative tools and equipment which can be used for the same task.
- Care and maintenance of tools and equipment.
- Safe use of hand and machine tools.
- Safety checks to carry out on electrical equipment before use.
- Checks before use including correct settings on machines such as lathes, milling machines and pillar drills.

## Processes

Understand a range of processes used to make control systems in the school workshop and manufacturing industry. In addition, candidates should be able to name tools and equipment appropriate to these processes, including:

- Preparing, marking out, measuring and testing; using a rule, try square, callipers, dividers, scribe, punches and electronic measuring instruments – digital vernier/micrometer/multimeter
- Additional processes: adhesives – PVA, epoxy resin, tensol; brazing; threading; use of nuts/bolts/screws, pop rivet
- Wasting; using hand-cutting tools for metal, wood, plastics, electronics; sawing, filing, planing, drilling, fine finishing, abrasives
- The use of jigs, fixtures, templates and patterns to aid quantity production
- Using machine tools: drill, lathe, milling machine, router; CNC tools: lathe, milling machine, router, vinyl cutter
- Forming processes – vacuum forming, line bending
- Assembly tools: screwdriver, soldering iron, wire cutters, wire strippers, spanners, pliers
- Finishing processes – self-finishing and applied surface finishes for protection and decoration, including polishing, painting, plating, plastic coating
- Process planning – stages involved in carrying out processes accurately and effectively; application of flow charts, block diagrams and tables to show sequence of operations.

## Computer applications

- Use CAD packages in the school environment for producing drawings and 2D/3D images
- Use on-screen modelling and manipulation of images
- Use text, database and graphics software appropriately in school and commercial situations
- Store and share data electronically
- Apply CAD/CAM to the designing and making of models and prototypes
- Apply CAD/CAM to one-off and quantity production
- Computer control machines (CNC) including lathes, milling machines, routers, machining centres, laser cutters, robots.

The areas in the following sections are optional. Candidates are only expected to study **one** area from mechanisms, electronics or pneumatics.

## Mechanisms

- General terms – load, effort, fulcrum, mechanical advantage, efficiency
- Components – gears, motors, pulleys, belts, chains, fixings eg nuts, bolts, washers, rivets
- Modular components – gearbox, modelling systems
- Levers – orders of lever and applications
- Types of motion – rotary, linear, oscillating, reciprocating
- Conversion of motion – crank, cam
- Transmission of motion:
  - Gearing systems: spur, bevel, helical, worm, rack and pinion, belt and pulley, sprocket and chain
  - Drive systems: splined shaft, plain and flexible couplings, tensioning drive belts and chains
  - Bearings and lubrication: types of bearing and materials used, lubrication systems
  - Control of motion: brakes, clutches
  - Motors, stepper motors, actuators
- Power sources – energy costs, conservation of energy
- Calculations – driver / driven speeds, rotational direction, mechanical advantage, velocity ratio.

## Electronics

- Components – selection, mounting and fixing of components, cable selection and use
- Power sources – battery, solar, capacitor, mains adaptor
- Discrete components – resistor, capacitor, diode, transistor, relay
- Sensors – for light, heat, sound, pressure
- ICs – voltage regulator, logic, PIC, op-amp, timer, drivers, logic family
- Switches/relays – types, configurations, applications
- Modular components – e, speech synthesiser, amplifier, LCD unit
- Circuit design – breadboard, CAD simulation, use of systems approach
- Circuit manufacture – PCB manufacture
- Input circuits – voltage regulation, sensors, eg LDR, thermistor, microphone, PIR, potential divider

- Processing circuits – PIC circuits, monostable, bistable, astable, transistor circuits, comparator
- Counters – clock circuit, binary counters, decade counters
- Logic – (AND, OR, NAND, NOR, NOT, XOR) application of logic gates singly and in combination
- Output circuits – LED 7 segment display, LCD display, drivers for relay, motor, solenoid, speaker
- Calculations – units of voltage, current, power, ohms law, potential divider
- Construction techniques – soldering, connecting between boards, ribbon cable/connecting plugs and sockets, PCB to case fittings
- Quality control – testing, fault identification, reworking.

## Pneumatics

### Materials and components

Candidates should be familiar with the use of the following components and be able to design and draw appropriate circuit diagrams:

Air supply	<ul style="list-style-type: none"> <li>• Compressor and reservoir/receiver, safety valve, regulator, pressure gauge, drain valve, operating pressures; safety features</li> </ul>
Cylinders	<ul style="list-style-type: none"> <li>• Single acting, double acting, cushioned, non-cushioned, reed switch</li> </ul>
Valves	<ul style="list-style-type: none"> <li>• 3/2 (3 port 2 way), 5/2, shuttle</li> </ul>
Valve control	<ul style="list-style-type: none"> <li>• Pushbutton, lever, plunger, foot pedal, roller trip, uni-directional roller, key, diaphragm, solenoid</li> </ul>
Restrictors (FCV)	<ul style="list-style-type: none"> <li>• Bi-directional, uni-directional</li> </ul>
Circuits	<ul style="list-style-type: none"> <li>• Air bleed occlusion, time delay, pressure decay sensing, automatic reciprocation, sequential control, signal amplification</li> </ul>
Logic Functions	<ul style="list-style-type: none"> <li>• OR using a shuttle valve, AND using 2 valves, NOT using an invert circuit</li> </ul>
Group air system	<ul style="list-style-type: none"> <li>• Used to avoid a dual signal in sequential control</li> </ul>
Calculations	<ul style="list-style-type: none"> <li>• Calculate the force (N), piston diameter, cross-sectional area (mm<sup>2</sup>), pressure (N/mm<sup>2</sup>) using <math>F = P \times A</math>    <math>A = \pi r^2</math> in simple examples and be able to use the results in a design situation.</li> </ul>

### Systems and control

Flowcharts	<ul style="list-style-type: none"> <li>• Design a flowchart for a control sequence; use inputs, outputs, process, feedback</li> </ul>
Computer/microcontroller	<ul style="list-style-type: none"> <li>• Design and understand pneumatic circuits controlled by computer/microcontroller, PICs, inputs from reed switched cylinders, outputs to solenoid valves, limit switches</li> </ul>
Integrating pneumatics	<ul style="list-style-type: none"> <li>• Integrating pneumatics with electronics and mechanisms</li> </ul>
Design	<ul style="list-style-type: none"> <li>• Design solutions for mounting and connecting components; design for making; design for safe application; problem solving and theoretical design for sustainability</li> </ul>
Vacuum principles	<ul style="list-style-type: none"> <li>• Vacuum cups used for lifting or holding work</li> </ul>
Hydraulics	<ul style="list-style-type: none"> <li>• Simple water circuits, syringes</li> </ul>
Modelling with air or water	<ul style="list-style-type: none"> <li>• Using syringes to model circuits with air or water</li> </ul>
Safety	<ul style="list-style-type: none"> <li>• Safety legislation for pneumatics; care when using compressed air and piping-up circuits, use of safety valves.</li> </ul>

## Generic content for all three areas:

### Quality

- Distinguish between quality of design and quality of manufacture
- Show how the quality of a product may be affected by materials and processes used in its manufacture
- Understand the importance of dimensional accuracy in component parts for assembly
- Describe simple quality-control checks to ensure accuracy and quality of finish.

### Health and safety

- Understand the responsibilities of designers and manufacturers to the workforce, the consumer and the general public
- Understand the importance of personal safety when engaged in designing and making activities, including:
  - Personal protective equipment
  - Machine guards
  - Dust and fume extraction
  - Waste disposal
  - Accident procedures
- Understand basic risk-assessment procedures
- Understand COSHH in the context of workshop and studio activities
- Understand the importance of following instructions provided for certain materials and processes
- Recognise and understand safety symbols used in the workshop or studio
- Be able to identify design modifications needed to make products safer to use.

### Product evaluation

- Establish the function of control systems; determine what the product or system was designed to do
- Determine the intended market or user of the product or system
- Identify the materials and components from which products or systems are made; give reasons why specific materials have been used by referring to the working properties of materials
- Identify the process used to make the product or system
- Compare a variety of commercially manufactured products and systems designed to meet the same need
- Test their own and commercially manufactured products and systems to determine fitness for purpose and identify improvements to the design, materials and processes used, with reference to technical efficiency, innovation, environmental and sustainability issues
- Evaluate their own and commercially manufactured products and systems against moral, cultural, environmental and sustainability issues
- Carry out a life-cycle analysis (LCA) on a variety of electronic products and systems.

## Delivery of the unit

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In this unit, candidates could develop their knowledge and understanding through:

- Focused practical tasks that develop a range of technical skills and knowledge of materials and processes
- Product analysis
- Design-and-make assignments that include activities relating to sustainability of products and resources, as well as industrial practices.

These tasks will vary in nature, some will be based around group discussion, others will involve the candidate working with ideas and media, researching concepts and recording information. Activities may also involve visits to particular Technology Innovation centres, museums and industry.

Evidence should be collected and recorded in the form of a research report (not assessed), which can be used at the end of the unit for examination preparation.

# 4 Schemes of Assessment

## 4.1 GCSE Scheme of Assessment

### GCSE Design and Technology: Electronics and Control Systems (J301)

#### Unit A511: *Introduction to designing and making*

30% of the total GCSE marks  
or  
60% of the GCSE (Short Course) marks  
20 hrs Controlled Assessment

This unit will involve candidates researching, designing and subsequently modelling a functional prototype. Candidates must select a theme set by OCR. See Appendix C. This theme can, however, be contextualised in order to suit centre-specific circumstances.

60 marks

- Teachers are required to ensure that candidates do not pursue the same theme for their work as submitted or intended for submission for Unit A513.
- Tasks (worksheets, modelling and prototyping) will be conducted under informal teacher supervision within tight guidelines specified by OCR. See Section 5.
- In addition to the formal 20 hours Controlled Assessment, there should also be further teaching time to increase the candidates' depth of knowledge and understanding in preparation for the Controlled Assessment.

The task will require the candidate to produce:

- A number of concise worksheets (A3, A4 or digital equivalent) showing design development and modelling, which may include the use of ICT to support the designing process
- A prototype product, capable of evaluation
- A minimum of two digital images/photographs of the final product, showing front and back views of the product in use
- Digital images/photographs of any models or mock-ups used by the candidate when designing, modelling or testing
- A completed OCR cover sheet.

The task must allow the candidate to:

- Develop and use research and investigation skills
- Develop drawing skills
- Use modelling
- Produce a prototype
- Evaluate the process.

Candidates must use appropriate ICT to help with their work. This might include computer-aided design and manufacture (CAD/CAM), control programmes, data analysis, and ICT-based sources for research and design relevant to the task.

The evidence presented for assessment must be submitted on paper or in electronic format. All digital evidence must be presented in an approved OCR format. See Appendix D.

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The whole internal assessment, including the final product, must not exceed 20 hours of work and must be undertaken under informal teacher supervision. Some of the work, by its very nature, may be undertaken outside school under limited supervision, eg research work, testing of the final product. See Section 5 for further details.

This Controlled Assessment is marked internally and externally moderated. Work is submitted through the OCR Repository or postally (paper/CD).

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It is not expected that the final product should accompany the portfolio during the external moderation process. However, the final product should be available should visiting moderation take place as part of monitoring.

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**Unit A512: *Sustainable design***

20% of the total GCSE marks  
or  
40% of the GCSE (Short Course)  
marks  
1 hr written paper  
  
60 marks

The paper will consist of questions that focus on sustainable design. Quality of Written Communication is assessed in this unit (see section 4.7).

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**Section A** consists of **15** short-answer questions.

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**Section B** consists of **three** questions requiring answers that may involve sketching, annotation, short sentences or more extended writing.

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This unit is externally examined.

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## Unit A513: *Making quality products*

30% of the total GCSE marks  
20 hrs Controlled Assessment  
  
60 marks

This unit will focus on the design and manufacture of a complete product from a theme set by OCR. See Appendix C. This should involve the candidate in the identification of a suitable design opportunity, generation of design ideas showing creativity, modelling and skilful manufacture of a quality product recording the key stages/processes of making and critical evaluation.

- Teachers are required to ensure that candidates do not pursue the same theme for their work as submitted or intended for submission for Unit A511.
- Tasks (worksheets and making) will be conducted under informal teacher supervision within tight guidelines specified by OCR. See Section 5.
- In addition to the formal 20 hours Controlled Assessment, there should also be further teaching time to increase the candidates' depth of knowledge and understanding in preparation for the Controlled Assessment.

The task will require the candidate to produce:

- A production plan
- A number of concise worksheets (A3, A4 or digital equivalent) showing design development and modelling, which may include the use of CAD to support the designing process
- A product capable of evaluation
- A minimum of two digital images/photographs of the final product showing front and back views of the product in use
- Digital images/photographs of any models or mock-ups used by the candidate when designing, modelling or testing
- A completed OCR cover sheet.

The task will allow the candidate to:

- Design for a need
- Work with tools and equipment
- Make a product
- Evaluate the product.

---

Candidates must use appropriate ICT to help with their work, including CAD/CAM, control programmes, data analysis, and ICT-based sources for research and design relevant to the task.

The evidence presented for assessment must be a portfolio of work submitted on paper or in electronic format. All digital evidence must be presented in an approved OCR format. See Appendix D.

The whole internal assessment portfolio, including the final product, must not exceed 20 hours of work and must be undertaken under informal teacher supervision. Some of the work, by its very nature, may be undertaken outside school under limited supervision, eg research work, testing of the final product. See Section 5 for further details.

---



---

This Controlled Assessment is marked internally and externally moderated. Work is submitted through the OCR Repository or postally (paper/CD).

It is not expected that the final product should accompany the portfolio during the external moderation process. However, the final product should be available should visiting moderation take place as part of monitoring.

Unit A514: *Technical aspects of designing and making*

20% of the total GCSE marks  
1 hr 15 mins written paper  
60 marks

There will be three question papers, one each for electronics, mechanisms and pneumatics. Candidates will choose **one** paper, corresponding to their chosen subject. Each paper will contain **two** sections. The papers will consist of questions that focus on technical aspects of designing and making. Quality of Written Communication is assessed in this unit (see section 4.7).

**Section A** consists of **three** questions based on the technical aspects of working with materials, tools and equipment.

**Section B** consists of **two** questions on the design of products reflecting the wider aspects of sustainability and human use. One of these questions will require a design response.

This unit is externally assessed.

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## 4.2 GCSE (Short Course) Scheme of Assessment

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Candidates taking the GCSE (Short Course) in Design and Technology: Electronics and Control Systems will need to be entered for Unit A511 and Unit A512. The scheme of assessment for these units is contained within Section 4.1.

## 4.3 Entry Options

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GCSE candidates must be entered for the appropriate units. All four units for GCSE and two units (A511 and A512) for the Short Course GCSE.

Candidates must also be entered for certification to claim their overall GCSE qualification grade. All candidates should be entered under the following certification codes:

OCR GCSE in Design and Technology: Electronics and Control Systems – J301

OCR GCSE (Short Course) in Design and Technology: Electronics and Control Systems – J041

## 4.4 Tiers

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This scheme of assessment is untiered, covering all of the ability range grades from A\* to G. Candidates achieving less than the minimum mark for Grade G will be ungraded.

## 4.5 Assessment Availability

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There are two examination series each year, in January and June.

From January 2010, all units will be available for assessment. All units will be available for assessment each January and June series.

Assessment availability can be summarised as follows:

Unit	January 2010	June 2010	January 2011	June 2011	January 2012 etc
A511	✓	✓	✓	✓	✓
A512	✓	✓	✓	✓	✓
A513	✓	✓	✓	✓	✓
A514	✓	✓	✓	✓	✓

## 4.6 Assessment Objectives

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

### AO1 Recall, select and communicate

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- Recall, select and communicate their knowledge and understanding in design and technology, including its wider effects

### AO2 Apply knowledge, understanding and skills

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- Apply knowledge, understanding and skills in a variety of contexts and in designing and making products

### AO3 Analyse and evaluate

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- Analyse and evaluate products, including their design and production.

### AO weightings – GCSE

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The relationship between the units and the assessment objectives of the scheme of assessment is shown in the following grid.

Unit	% of GCSE			Total
	AO1	AO2	AO3	
Unit A511: <i>Introduction to designing and making</i>	8	18	4	30
Unit A512: <i>Sustainable design</i>	9	7	4	20
Unit A513: <i>Making quality products</i>		25	5	30
Unit A514: <i>Technical aspects of designing and making</i>	17		3	20
	34%	50%	16%	100%

### AO weightings – GCSE (Short Course)

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The relationship between the units and the assessment objectives of the scheme of assessment is shown in the following grid.

Unit	% of GCSE (Short Course)			Total
	AO1	AO2	AO3	
Unit A511: <i>Introduction to designing and making</i>	16	36	8	60
Unit A512: <i>Sustainable design</i>	18	14	8	40
	34%	50%	16%	100%

## 4.7 Quality of Written Communication

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Quality of written communication is assessed in all units.

Candidates are expected to:

- Ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
- Use technical language as appropriate
- Present information in a form that suits its purpose
- Use a suitable structure and style of writing.

# 5 Controlled Assessment

## 5.1 The Controlled Assessment Units

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Units A511 and A513 have been designed to be internally assessed, applying the principles of Controlled Assessment. Controls are set within the assessments so that validity and reliability are ensured and the assessors can confidently authenticate the candidates' work. These controls take a variety of forms in each of the stages of the assessment process: task setting, task taking and task marking. Within each of these three stages there are different levels of control. This section sets out the overall OCR approach, but the Scheme of Assessment sections of the units include more detail and any specific requirements.

## 5.2 Task Setting

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### 5.2.1 The OCR approach

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OCR will assume a high level of control in relation to the setting of tasks. A number of Controlled Assessment tasks will be available from OCR for the Controlled Assessment units. These tasks have been designed to meet the full assessment requirements of the unit. Candidates will need to take part in a planned learning programme that covers the underpinning knowledge and skills of the unit in addition to completing the evidence requirements of the designated assessment tasks.

### 5.2.2 Using Controlled Assessment tasks

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Centres can choose one from a number of theme-based tasks offered by OCR. See Appendix C. These tasks can be used with a minimum amount of adaptation or they can be adapted so that they allow the usage of local resources available to any centre. These tasks may also be set within overarching scenarios and briefs more relevant to centres' own environment and targeted at their particular cohorts of candidates.

Controlled Assessment tasks may be adapted by centres in ways which will not put at risk the opportunity for candidates to meet the Assessment Criteria, including the chance to gain marks at the highest level. For some units, this may allow for little to be adapted other than minor cosmetic details, eg the description and nature of the product on which a task is based. For other units, the medium in which the candidates are working may be a matter of choice. Each Controlled Assessment task (Appendix C) will include a section which briefly specifies the type and degree of adaptation which is appropriate.

The same OCR Controlled Assessment task must NOT be used as the practice material and then as the actual live assessment material. Centres should devise their own practice material using the OCR specimen Controlled Assessment task as guidance.

## 5.3 Task Taking

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### 5.3.1 The OCR approach

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For GCSE in Design and Technology: Electronics and Control Systems, OCR will assume a medium level of control in the undertaking of tasks. The task-taking parameters will be defined for several key controls and the remainder set by centres as outlined below.

### 5.3.2 Definitions of the controls

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(a) **Authenticity control:** Candidates will complete all work for assessment under direct teacher supervision except as outlined below. For GCSE in Electronics and Control Systems, most, but not all, work for assessment would be under direct teacher supervision. For example, it is acceptable for some aspects of exploration to be outside the direct supervision of the teacher but the teacher must be able to authenticate the work and insist on acknowledgement and referencing of any sources used.

(b) **Feedback control:** Feedback to candidates will be encouraged but tightly defined. Within GCSE in Electronics and Control Systems, OCR expects teachers to supervise and guide candidates who are undertaking work which is internally assessed. The degree of teacher guidance in candidates' work will vary according to the kinds of work being undertaken. It should be remembered, however, that candidates are required to reach their own judgements and conclusions. When supervising tasks, teachers are expected to:

- Offer candidates advice about how best to approach such tasks
- Review candidates' work, and provide advice at a general level. Teachers must not, however, provide detailed and specific advice on how the work may be improved to meet the assessment criteria
- Exercise continuing supervision of work in order to monitor progress and to prevent plagiarism
- Exercise continuing supervision of practical work to ensure essential compliance with Health and Safety requirements
- Ensure that the work is completed in accordance with the specification requirements and can be assessed in accordance with the specified marking criteria and procedures

(c) **Time control:** The time limit available to candidates to complete the assessment task is 20 hours, as specified within the unit. Tasks will be set within a broader learning programme which will allow the acquisition of subject specific knowledge and the development of appropriate practical skills.

Controlled Assessed work should be completed within the time limit and supervised and marked by the teacher. Some of the work, by its very nature, may be undertaken outside the centre, eg research work, testing. It is likely that using or applying this material will be undertaken under direct teacher supervision. With all internally assessed work, the teacher must be satisfied that the work submitted for assessment is the candidate's own work and be able to authenticate it using the specified procedure.

(d) **Collaboration control:** Candidates must complete and/or evidence all work individually. With reference to collaboration control, all assessment evidence will be provided by the individual candidate. Where group work is undertaken, it is vital to be able to identify the unique individual contribution made by each candidate.

(e) **Resource control:** Candidates will need to be provided with the most appropriate materials and equipment to allow them full access to the marking criteria. For units A511 and A513, basic workshop equipment will be adequate. However, the use of specialist equipment and ICT may be required to enable the candidate to produce the desired outcome. Candidates may also need access to resources and processes only available outside the centre environment.

### 5.3.3 Quality assuring the controls

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It is the responsibility of the Head of Centre to ensure that the controls set out in the specification and the individual units are imposed.

### 5.3.4 Completing the tasks

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Candidates should be allowed sufficient time to complete all of the tasks. It is suggested that evidence is produced in several sessions, each focusing on a specific task within the overall task or scenario. These may be interspersed with opportunities to learn knowledge and develop appropriate practical skills.

Each candidate must produce individual and authentic evidence for each of the tasks. It is particularly important that candidates working in groups, where the unit allows this, should still produce individual evidence of their contribution to ongoing group work and any final realisation or outcome.

Centre staff may give support and guidance to candidates. This support and guidance should focus on checking that candidates understand what is expected of them and that they work safely. Candidates will also need support and guidance when accessing materials provided by the centre.

Candidates may use information from any relevant source to help them with producing evidence for the tasks.

In general, candidates must be guided on the use of information from other sources to ensure that confidentiality and intellectual property rights are maintained at all times. It is essential that any material directly used from a source is appropriately and rigorously referenced. Where a dataset or case material is provided, it is acknowledged that candidates in their responses will refer to situations in the assessment material, but as this is fictitious it does not break any rules of confidentiality or copyright.

### 5.3.5 Presentation of work

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Candidates must observe certain procedures in the production of Controlled Assessments.

- Tables, graphs and spreadsheets may be produced using appropriate ICT. These should be inserted into the report at the appropriate place.
- Any copied material must be suitably acknowledged.
- Quotations must be clearly marked and a reference provided wherever possible.
- Work submitted for moderation or marking must be clearly identified with the:
  - centre number
  - centre name
  - candidate number
  - candidate name
  - unit code and title
  - task title.

Work submitted on paper for moderation must be secured either in a notebook, portfolio case or by treasury tags. Work submitted in digital format (CD or online) must be in a suitable file structure as detailed in Appendix D.

## 5.4 Task Marking

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### 5.4.1 The OCR approach

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For GCSE in Design and Technology: Electronics and Control Systems, OCR will assume a medium level of control in relation to the marking of tasks. All Controlled Assessment units will be marked by the centre assessor(s) using awarding-body marking criteria and guidance, and moderated by the OCR-appointed moderator. For this GCSE, external moderation will take the form of postal moderation or e-moderation where digital evidence is uploaded to the OCR Repository.

### 5.4.2 Applying the assessment criteria

---

The starting point for marking the tasks is the marking criteria within each unit. These contain levels of the skills, knowledge and understanding that the candidate is required to demonstrate. Before the start of the course, and for use at INSET training events, OCR will provide exemplification through real or simulated candidate work, which will help to clarify the level of achievement the assessors will be looking for.

### 5.4.3 Use of 'best fit' approach to marking criteria

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The assessment task(s) for each unit should be marked by the teacher according to the given marking criteria within the relevant unit using a 'best fit' approach. For each of the assessment criteria, one of the descriptors provided in the marking grid that most closely describes the quality of the work being marked should be selected.

Marking should be positive, rewarding achievement rather than penalising failure or omissions. The award of marks **must be** directly related to the marking criteria.

Step 1: Teachers use their professional judgement in selecting the descriptor that best describes the work of the candidate.

Step 2: To select the most appropriate mark within the descriptor, teachers should use the following guidance:

- Where the candidate's work *convincingly* meets the statement, the highest mark should be awarded
- Where the candidate's work *adequately* meets the statement, the most appropriate mark in the middle range should be awarded
- Where the candidate's work *just* meets the statement, the lowest mark should be awarded.

Centres should use the full range of marks available to them; centres must award *full* marks in any band for work which fully meets that descriptor. This is work which is 'the best one could expect from candidates working at that level'. Where there are only two marks within a band the choice will be between work which, in most respects, meets the statement and work which just meets the statement. For wider mark bands, the marks on either side of the middle mark(s) for 'adequately met' should be used where the standard is lower or higher than 'adequate' but **not** the highest or lowest mark in the band.



Only one mark per unit will be entered. The final mark for the candidate for each unit is out of a total of 60 and is found by totalling the marks for each of the marking criteria strands.

#### 5.4.4 Authentication

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Teachers/course tutors must be confident that the work they mark is the candidate's own. This does not mean that a candidate must be supervised throughout the completion of all work but the teacher/course tutor must exercise sufficient supervision, or introduce sufficient checks, to be in a position to judge the authenticity of the candidate's work.

Wherever possible, the teacher/course tutor should discuss work-in-progress with candidates. This will not only ensure that work is underway in a planned and timely manner but will also provide opportunities for assessors to check authenticity of the work and provide general feedback.

Candidates must not plagiarise. Plagiarism is the submission of another's work as one's own and/or failure to acknowledge the source correctly. Plagiarism is considered to be malpractice and could lead to the candidate being disqualified. Plagiarism sometimes occurs innocently when candidates are unaware of the need to reference or acknowledge their sources. It is therefore important that centres ensure that candidates understand that the work they submit must be their own and that they understand the meaning of plagiarism and what penalties may be applied. Candidates may refer to research, quotations or evidence but they must list their sources. The rewards from acknowledging sources, and the credit they will gain from doing so, should be emphasised to candidates, as well as the potential risks of failing to acknowledge such material. Centres should reinforce this message to ensure candidates understand what is expected of them.

**Please note:** Centres must confirm to OCR that the evidence produced by candidates is authentic. It is a requirement of the QCA Common Criteria for all Qualifications that proof of authentication is received. Failure to provide centre authentication could result in candidates being penalised.

#### 5.4.5 Internal standardisation

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It is important that all internal assessors, working in Design and Technology, work to common standards. Centres must ensure that the internal standardisation of marks across assessors and teaching groups takes place using an appropriate procedure.

This can be done in a number of ways. In the first year, reference material and OCR training meetings will provide a basis for centres' own standardisation. In subsequent years, this, or centres' own archive material, may be used. Centres are advised to hold preliminary meetings of staff involved to compare standards through cross-marking a small sample of work. After most marking has been completed, a further meeting at which work is exchanged and discussed will enable final adjustments to be made.

## 5.4.6 Moderation

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- Teachers mark the tasks using the assessment criteria and guidelines provided by OCR.
- OCR moderators externally moderate the teachers' marking to ensure that the assessment criteria have been applied fairly and consistently to the national standard. On the basis of this moderation, scaled adjustments may be recommended

Following marking and internal standardisation by the centre, candidate marks are submitted to OCR, after which moderation takes place in accordance with OCR procedures: refer to the OCR website for submission dates of the marks to OCR. The purpose of moderation is to ensure that the standard of the award of marks for work 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 which is presented to the Moderator for moderation must show how the marks have been awarded in relation to the marking criteria defined in Appendix B.

Each candidate's work should have a cover sheet attached to it with a summary of the marks awarded for each task. If the work is to be submitted in digital format, this cover sheet should also be submitted electronically within each candidate's files.

## 5.5 Minimum Requirements for Controlled Assessment

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There should be clear evidence that work has been attempted and some work produced.

If a candidate submits no work for an internally assessed component, then the candidate should be indicated as being absent from that component on the mark sheets submitted to OCR. If a candidate completes any work at all for an internally assessed component, then the work should be assessed according to the internal assessment objectives and marking instructions and the appropriate mark awarded, which may be zero.

# 6 Technical Information

## 6.1 Making Unit Entries

Centres can enter candidates for all units, in a traditional linear fashion, at the end of the course OR at any June or January session subject to the terminal rules.

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 and/or moderator details for Controlled Assessments.

**It is essential** that unit entry codes are quoted in all correspondence with OCR.

Unit Entry code	Component code	Submission method	Unit titles
A511	01	<i>OCR Repository</i>	<i>Introduction to designing and prototyping</i>
	02	<i>Postal moderation</i>	
A512	-	-	<i>Sustainable design</i>
A513	01	<i>OCR Repository</i>	<i>Making quality products</i>
	02	<i>Postal moderation</i>	
A514			<i>Technical aspects of designing and making:</i>
	01	-	<i>Electronics paper</i>
	02	-	<i>Pneumatics paper</i>
	03	-	<i>Mechanisms paper</i>

For Units A511 and A513 candidates must be entered for either component 01 or 02. Centres must enter all of their candidates for ONE of these components. It is not possible for centres to offer both components within the same series.

## 6.2 Terminal Rules

Candidates must take at least 40% of the assessment in the same series they enter for either the full course or short course qualification certification.

This rule means that candidates certificating for GCSE Design and Technology: Electronics and Control Systems (J301) must also be entered in the same examination session for ANY two of the four units.

This rule means that candidates certificating for GCSE (Short Course) Design and Technology: Electronics and Control Systems (J041) must also be entered in the same examination session for ANY one of the two units.

## 6.3 Unit and Qualification Re-sits

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Candidates may re-sit each unit once before entering for certification for a GCSE or GCSE (Short Course).

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

## 6.4 Making Qualification Entries

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Candidates must enter for qualification certification (J301, J041) separately from unit assessment(s). If a certification entry is not made, no overall grade can be awarded.

Candidates may enter for:

- GCSE certification (entry code J301).
- GCSE (Short Course) certification (entry code J041).

A candidate who has completed all the units required for the qualification must enter for certification in the same examination series in which the terminal rules are satisfied.

Short Course GCSE certification is available for the first time in June 2010, and each January and June thereafter.

Full GCSE certification is available for the first time in June 2011, and each January and June thereafter.

## 6.5 Grading

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Both GCSE (Short Course) and GCSE results are awarded on the scale A\* to G. Units are awarded a\* to g. Grades are indicated on certificates. However, results for candidates who fail to achieve the minimum grade (G or g) will be recorded as unclassified (U or u) and this is not certificated.

Both GCSE (Short Course) and GCSE are unitised schemes. Candidates can take units across several different series provided the terminal rules are satisfied. They can also re-sit units or choose from optional units available. When working out candidates' overall grades, OCR needs to be able to compare performance on the same unit in different series when different grade boundaries have been set, and between different units. OCR uses a Uniform Mark Scale to enable this to be done.

A candidate's uniform mark for each unit is calculated from the candidate's raw marks on that unit. The raw mark boundary marks are converted to the equivalent uniform mark boundary. Marks between grade boundaries are converted on a pro rata basis.

When unit results are issued, the candidate's unit grade and uniform mark are given. The uniform mark is shown out of the maximum uniform mark for the unit, eg 41/80.

The specification is graded on a Uniform Mark Scale. The uniform mark thresholds for each of the assessments are shown below:

(GCSE) Unit Weighting	Maximum Unit Uniform Mark	Unit Grade								u
		a*	a	b	c	d	e	f	g	
20%	80	72	64	56	48	40	32	24	16	0
30%	120	108	96	84	72	60	48	36	24	0

Candidate's uniform marks for each unit are aggregated and grades for the specification are generated on the following Uniform Mark Scale.

Qualification	Maximum Uniform Mark	Qualification Grade								U
		A*	A	B	C	D	E	F	G	
GCSE (Short Course)	200	180	160	140	120	100	80	60	40	0
GCSE	400	360	320	280	240	200	160	120	80	0

## Awarding Grades

The written papers will have a total weighting of 40% and Controlled Assessment a weighting of 60%.

A candidate's uniform mark for each paper will be combined with the uniform mark for the Controlled Assessment to give a total uniform mark for the specification. The candidate's grade will be determined by the total uniform mark.

## 6.6 Enquiries about Results

Under certain circumstances, a centre may wish to query the result issued to one or more candidates. Enquiries about Results for GCSE units must be made immediately following the series in which the relevant unit was taken (by the Enquiries about Results deadline).

Please refer to the *JCQ Post-Results Services* booklet and the *OCR Admin Guide* for further guidance about action on the release of results. Copies of the latest versions of these documents can be obtained from the OCR website.

## 6.7 Shelf-Life of Units

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

## 6.8 Guided Learning Hours

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GCSE Design and Technology: Electronics and Control Systems requires 120-140 guided learning hours in total.

GCSE (Short Course) in Design and Technology: Electronics and Control Systems requires 60-70 guided learning hours in total.

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

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

## 6.10 Classification Code

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Every specification is assigned a national classification code indicating the subject area to which it belongs. The classification codes for these specifications are 9010 and 9060.

Centres should be aware that candidates who enter for more than one GCSE 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.

Centres may wish to advise candidates that, if they take two specifications with the same classification code, schools and colleges are very likely to take the view that they have achieved only one of the two GCSEs. The same view may be taken if candidates take two GCSE specifications that have different classification codes but have significant overlap of content. Candidates who have any doubts about their subject combinations should seek advice, for example from their centre or the institution to which they wish to progress.

## 6.11 Disability Discrimination Act Information Relating to this Specification

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GCSEs 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 GCSE qualifications 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 and to demonstrate what they know and can do. For this reason, very few candidates will have a complete barrier to the assessment. Information on reasonable adjustments is found in *Regulations and Guidance Relating to Candidates who are Eligible for Adjustments in Examinations* produced by the Joint Council [www.jcq.org.uk](http://www.jcq.org.uk).

Candidates who are unable to access part of the assessment, even after exploring all possibilities through reasonable adjustments, may still be able to receive an award based on the parts of the assessment they have taken.

The access arrangements permissible for use in this specification are in line with QCA's GCSE subject criteria equalities review and are as follows:

	Yes/No	Type of assessment
Readers	Y	All written and practical assessments
Scribes	Y	All written and practical assessments
Practical assistants	Y	Practical assessments
Word processors	Y	All written and practical assessments
Transcripts	Y	All written and practical assessments
BSL signers	Y	All written and practical assessments
Live speaker	Y	All written and practical assessments
MQ papers	Y	All written and practical assessments
Extra time	Y	All written and practical assessments

We do not foresee any part of the assessment forming a barrier to any student. There are design and technology endorsements which will pose barriers for some disabled learners.

Learners with a physical disability may be limited in the range of designing and making contexts they can use, but this should not pose a barrier to assessment.

For example, candidates may use CAD/CAM for the making process, and practical assistants may be used to support students with physical disabilities in this process.

Candidates with a visual impairment may find elements of the assessment difficult, such as graphics, however there should be no barriers to assessment.

It is important to note that where access arrangements are permitted, they must not be used in a way that undermines the integrity of the assessment. For example, practical assistants can be used to help learners set up but cannot help perform skills which are assessed, such as the ability to physically manipulate equipment.

## 6.12 Arrangements for Candidates with Particular Requirements

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Candidates who are not disabled under the terms of the DDA may be eligible for access arrangements to enable them to demonstrate what they know and can do. Candidates who have been fully prepared for the assessment but who are ill at the time of the examination, or are too ill to take part of the assessment, may be eligible for special consideration. Centres should consult the *Regulations and Guidance Relating to Candidates who are Eligible for Adjustments in Examinations* produced by the Joint Council.

## 6.13 OCR Repository

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The OCR Repository allows centres to submit moderation samples in electronic format.

The OCR GCSE Design and Technology: Electronics and Control Systems units A511 and A513 can be submitted electronically to the OCR Repository via Interchange: please check Section 6.1 for unit entry codes for the OCR Repository.

More information on the OCR Repository can be found in Appendix D: Guidance for the Production of Electronic Controlled Assessment. Instructions for how to upload files to OCR using the OCR Repository can be found on OCR Interchange.



# 7 Other Specification Issues

## 7.1 Overlap with other Qualifications

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There is no significant overlap between the content of these specifications and those for other GCSE qualifications.

## 7.2 Progression from these Qualifications

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GCSE qualifications are general qualifications which enable candidates either to progress directly to employment, or to proceed to further qualifications.

Progression to further study from GCSE will depend upon the number and nature of the grades achieved. Broadly, candidates who are awarded mainly Grades D to G at GCSE could either strengthen their base through further study of qualifications at Level 1 within the National Qualifications Framework or could proceed to Level 2. Candidates who are awarded mainly Grades A\* to C at GCSE would be well prepared for study at Level 3 within the National Qualifications Framework.

Candidates may progress to GCE in Design and Technology or the Principal Learning in Engineering or Manufacturing.

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

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

- Imaginative and creative activity in their own practical Controlled Assessment, and develop an appreciation of the imagination and creativity of others in design technology
- Moral, cultural, economic, environmental and sustainability issues inherent in design and technology
- Moral implications of some applications of technological activities
- The relationship between cultures and societies, the influence they have on designing and making, and that the impact products have on lifestyle
- The role of technology in the context of national and European citizenship.

There are no direct references to spiritual issues within these specifications. However, opportunities may exist to explore this area through the designing and making of products that relate to a religious or spiritual context.

## 7.4 Sustainable Development, Health and Safety Considerations and European Developments consistent with International Agreements

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

- Global design and technology activities, not solely restricted to Europe; multicultural design and making responses arising from identifiable needs and opportunities. These specifications do not make specific reference to European developments; however, these may be drawn into the course of study in many ways, eg European Safety Standards.
- Emerging and existing technologies in other European countries and the world
- Ways in which economic, environmental, ethical and social dimensions interact to influence designing and making
- Health and safety when working with tools, equipment, components and materials
- Sustainability in making decisions and combining skills with knowledge and understanding in order to design and make quality products.

## 7.5 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.

## 7.6 Language

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These specifications and associated assessment materials are in English only.

## 7.7 Key Skills

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This specification provides 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 1 and/or 2. 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 1 and/or 2 for each unit.

Unit	C		AoN		IT		WwO		IoLP		PS	
	1	2	1	2	1	2	1	2	1	2	1	2
A511	✓	✓			✓	✓	✓		✓	✓	✓	✓
A512	✓	✓			✓	✓			✓	✓	✓	✓
A513	✓	✓			✓	✓			✓	✓	✓	✓
A514	✓	✓	✓	✓	✓	✓	✓					

Detailed opportunities for generating Key Skills evidence through this specification are posted on the OCR website ([www.ocr.org.uk](http://www.ocr.org.uk)). A summary document for Key Skills Coordinators showing ways in which opportunities for Key Skills arise within GCSE courses has been published.

## 7.8 ICT

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In order to play a full part in modern society, candidates need to be confident and effective users of ICT. Where appropriate, candidates should be given opportunities to use ICT in order to further their study of CAD, CAM, data handling, word processing.

The assessment of this course, for example, requires candidates to produce creative and original ideas by generating, developing and communicating designs using appropriate strategies including the use of CAD.

## 7.9 Citizenship

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Since September 2002, the National Curriculum for England at Key Stage 4 has included a mandatory programme of study for Citizenship. Parts of this Programme of Study may be delivered through an appropriate treatment of other subjects.

There are opportunities for developing knowledge, skills and understanding of citizenship issues particularly in units A511 and A513.

# Appendix A: Grade Descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the assessment may be balanced by better performance in others.

The grade descriptors have been produced by the regulatory authorities in collaboration with the awarding bodies.

## **Grade F**

Candidates recall, select and communicate knowledge and understanding of basic aspects of design and technology, including its wider effects.

They apply limited knowledge, understanding and skills to plan and carry out simple investigations and tasks, with an awareness of the need for safety and precision. They modify their approach in the light of progress.

They review their evidence and draw basic conclusions.

## **Grade C**

Candidates recall, select and communicate sound knowledge and understanding of design and technology, including its wider effects.

They apply knowledge, understanding and skills in a range of situations to plan and carry out investigations and tasks. They test their solutions, working safely and with precision.

They review the evidence available, analysing and evaluating some information clearly, and with some accuracy. They make judgments and draw appropriate conclusions.

## **Grade A**

Candidates recall, select and communicate detailed knowledge and thorough understanding of design and technology, including its wider effects.

They apply relevant knowledge, understanding and skills in a range of situations to plan and carry out investigations and tasks effectively. They test their solutions, working safely and with a high degree of precision.

They analyse and evaluate the evidence available, reviewing and adapting their methods when necessary. They present information clearly and accurately, making reasoned judgements and presenting substantiated conclusions.

# Appendix B: Marking Criteria for Controlled Assessments

Unit A511

Basic ability	Demonstrates ability	Works competently with independence
<p><b>Creativity</b></p> <ul style="list-style-type: none"> <li>• Make simple/limited links between principles of good design and technological knowledge, showing limited awareness of the user.</li> <li>• Identify one or two trends in existing solutions and use this understanding in a design context.</li> </ul> <p>[0 - 3]</p>	<p><b>Creativity</b></p> <ul style="list-style-type: none"> <li>• Identify associations linking principles of good design and technological knowledge, relating products to users' needs.</li> <li>• Demonstrate the significance of research that identifies trends in existing solutions; interpret and apply this understanding in a design context.</li> </ul> <p>[4 - 7]</p>	<p><b>Creativity</b></p> <ul style="list-style-type: none"> <li>• Identify complex associations linking principles of good design and technological knowledge, relating products to users' needs and wants. (AO1)</li> <li>• Demonstrate and understand the significance of trends in existing solutions; reinterpret and apply this understanding in imaginative ways. (AO1)</li> </ul> <p>[8 - 10]</p>
<p><b>Designing</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a limited response to a brief and produce a simple specification for a prototype.</li> <li>• Produce one or two simple design ideas using a limited range of strategies.</li> </ul> <p>[0 - 4]</p>	<p><b>Designing</b></p> <ul style="list-style-type: none"> <li>• Demonstrate an appropriate response to a brief and produce a suitable specification for a prototype product as a result of analysis.</li> <li>• Produce creative ideas and communicate these by using appropriate strategies.</li> </ul> <p>[5 - 10]</p>	<p><b>Designing</b></p> <ul style="list-style-type: none"> <li>• Demonstrate an appropriate and considered response to a brief and produce a detailed specification for a prototype product as a result of analysis. (AO2)</li> <li>• Produce creative and original ideas by generating, developing and communicating designs using appropriate strategies. (AO2)</li> </ul> <p>[11 - 14]</p>

Basic ability	Demonstrates ability	Works competently with independence
<p><b>Making</b></p> <ul style="list-style-type: none"> <li>• Plan and organise activities:               <ul style="list-style-type: none"> <li>○ Select and use appropriate materials</li> <li>○ Select and use hand and machine tools as appropriate to realise the prototype.</li> </ul> </li> <li>• Work safely to assemble, construct and finish materials and components as appropriate to generate a prototype.</li> <li>• Use workshop/design studio facilities as appropriate to realise the prototype.</li> </ul> <p style="text-align: right;"><b>[0 - 6]</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a simple understanding of how to solve technical problems as they arise.</li> </ul> <p style="text-align: right;"><b>[0 - 1]</b></p> <ul style="list-style-type: none"> <li>• Simply record the making of the prototype using notes and/or photographic evidence.</li> </ul> <p style="text-align: right;"><b>[0 - 1]</b></p>	<p><b>Making</b></p> <ul style="list-style-type: none"> <li>• Plan and organise activities:               <ul style="list-style-type: none"> <li>○ Select and use appropriate materials</li> <li>○ Select and use hand and machine tools as appropriate to realise the prototype.</li> </ul> </li> <li>• Work effectively and safely to assemble, construct and finish materials and components as appropriate to achieve a good quality prototype.</li> <li>• Choose and use workshop/design studio facilities as appropriate to realise the prototype.</li> </ul> <p style="text-align: right;"><b>[7 - 13]</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a practical understanding and ability in solving some technical problems as they arise.</li> </ul> <p style="text-align: right;"><b>[2 - 3]</b></p> <ul style="list-style-type: none"> <li>• Record key stages involved in the making of the prototype; provide notes and photographic evidence.</li> </ul> <p style="text-align: right;"><b>[2 - 3]</b></p>	<p><b>Making</b></p> <ul style="list-style-type: none"> <li>• Plan and organise activities:               <ul style="list-style-type: none"> <li>○ Select and use appropriate materials. (AO1/AO2)</li> <li>○ Select and use hand and machine tools as appropriate to realise the prototype. (AO1/AO2)</li> </ul> </li> <li>• Work skilfully and safely to assemble, construct and finish materials and components as appropriate to achieve a high quality prototype. (AO2)</li> <li>• Assess and apply knowledge of the workshop/design studio facilities as appropriate to realise the prototype. (AO1/AO2)</li> </ul> <p style="text-align: right;"><b>[14 - 20]</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a practical and thorough understanding and ability in solving technical problems effectively and efficiently as they arise. (AO2)</li> </ul> <p style="text-align: right;"><b>[4]</b></p> <ul style="list-style-type: none"> <li>• Record key stages involved in the making of the prototype product; provide comprehensive notes and photographic evidence. (AO2)</li> </ul> <p style="text-align: right;"><b>[4]</b></p>
<p><b>Critical evaluation</b></p> <ul style="list-style-type: none"> <li>• Give a limited evaluation of the modelling and prototyping process.</li> <li>• There will be little or no use of specialist terms.</li> <li>• Answers may be ambiguous or disorganised.</li> <li>• Errors of spelling, punctuation and grammar may be intrusive.</li> </ul> <p style="text-align: right;"><b>[0 - 2]</b></p>	<p><b>Critical evaluation</b></p> <ul style="list-style-type: none"> <li>• Give an evaluation of the making process.</li> <li>• Reflect on how to improve the modelling and prototyping process.</li> <li>• There will be some use of specialist terms, although these may not always be used appropriately.</li> <li>• The information will be presented for the most part in a structured format.</li> <li>• There may be occasional errors in spelling, punctuation and grammar.</li> </ul> <p style="text-align: right;"><b>[3 - 5]</b></p>	<p><b>Critical evaluation</b></p> <ul style="list-style-type: none"> <li>• Critically evaluate the processes involved in designing and making the prototype. (AO3)</li> <li>• Reflect and suggest modifications to improve the modelling and prototyping process. (AO3)</li> <li>• Specialist terms will be used appropriately and correctly.</li> <li>• The information will be presented in a structured format.</li> <li>• The candidate can demonstrate the accurate use of spelling, punctuation and grammar.</li> </ul> <p style="text-align: right;"><b>[6 - 8]</b></p>

Basic ability	Demonstrates ability	Works competently with independence
<p><b>Designing</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a limited response to a brief and produce a simple specification for a product.</li> </ul> <p style="text-align: right;"><b>[0-1]</b></p> <ul style="list-style-type: none"> <li>• Produce one or two simple design ideas using a limited range of strategies.</li> </ul> <p style="text-align: right;"><b>[0-5]</b></p>	<p><b>Designing</b></p> <ul style="list-style-type: none"> <li>• Demonstrate an appropriate response to a brief and produce a suitable specification for a product as a result of analysis.</li> </ul> <p style="text-align: right;"><b>[2-3]</b></p> <ul style="list-style-type: none"> <li>• Produce a range of creative ideas and communicate these by using appropriate strategies.</li> </ul> <p style="text-align: right;"><b>[6-8]</b></p>	<p><b>Designing</b></p> <ul style="list-style-type: none"> <li>• Demonstrate an appropriate and considered response to a brief and produce a detailed specification for a product as a result of analysis. (AO2)</li> </ul> <p style="text-align: right;"><b>[4]</b></p> <ul style="list-style-type: none"> <li>• Produce creative and original ideas by generating, developing and communicating designs using a range of appropriate strategies. (AO2)</li> </ul> <p style="text-align: right;"><b>[9-12]</b></p>
<p><b>Making</b></p> <ul style="list-style-type: none"> <li>• Plan and organise activities: <ul style="list-style-type: none"> <li>○ Select and use appropriate materials</li> <li>○ Select and use equipment as appropriate to the material area</li> </ul> </li> <li>• Work safely to shape, form, assemble and finish materials or components as appropriate.</li> <li>• Use workshop facilities as appropriate to the material area.</li> <li>• The product will exhibit a low standard of outcome and may not be successfully completed.</li> </ul> <p style="text-align: right;"><b>[0-9]</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a simple understanding of how to solve technical problems as they arise.</li> </ul> <p style="text-align: right;"><b>[0-2]</b></p> <ul style="list-style-type: none"> <li>• Simply record the making of the product using notes and/or photographic evidence.</li> </ul> <p style="text-align: right;"><b>[0-2]</b></p>	<p><b>Making</b></p> <ul style="list-style-type: none"> <li>• Plan and organise activities: <ul style="list-style-type: none"> <li>○ Select and use appropriate materials</li> <li>○ Select and use equipment as appropriate to the material area</li> </ul> </li> <li>• Work effectively and safely to shape, form, assemble and finish materials or components as appropriate.</li> <li>• Select and use workshop facilities as appropriate to the material area.</li> <li>• The product will be completed to a good standard and will meet most of the requirements of the final product specification.</li> </ul> <p style="text-align: right;"><b>[10-17]</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a practical understanding and ability in the solving of some technical problems as they arise.</li> </ul> <p style="text-align: right;"><b>[3-4]</b></p> <ul style="list-style-type: none"> <li>• Record key stages involved in the making of the product; provide notes and photographic evidence.</li> </ul> <p style="text-align: right;"><b>[3-4]</b></p>	<p><b>Making</b></p> <ul style="list-style-type: none"> <li>• Plan and organise activities: <ul style="list-style-type: none"> <li>○ Select and use appropriate materials</li> <li>○ Select and use equipment as appropriate to the material area. (AO2)</li> </ul> </li> <li>• Work skilfully and safely to shape, form, assemble and finish materials or components as appropriate. (AO2)</li> <li>• Assess and apply knowledge in the workshop facilities as appropriate to the material area. (AO2)</li> <li>• The product will be completed to a high standard and will fully meet the requirements of the final product specification. (AO2)</li> </ul> <p style="text-align: right;"><b>[18-24]</b></p> <ul style="list-style-type: none"> <li>• Demonstrate a practical and thorough understanding in the solving of technical problems effectively and efficiently as they arise. (AO2/AO3)</li> </ul> <p style="text-align: right;"><b>[5-6]</b></p> <ul style="list-style-type: none"> <li>• Record key stages involved in the making of the product; provide comprehensive notes and photographic evidence. (AO2)</li> </ul> <p style="text-align: right;"><b>[5-6]</b></p>

Basic ability	Demonstrates ability	Works competently with independence
<p><b>Critical evaluation</b></p> <ul style="list-style-type: none"> <li>• Give a limited evaluation of the finished product with some reference to the specification.</li> <li>• There is no evidence of testing the product in use.</li> <li>• There will be little or no use of specialist terms.</li> <li>• Answers may be ambiguous or disorganised.</li> <li>• Errors of spelling, punctuation and grammar may be intrusive.</li> </ul> <p style="text-align: right;"><b>[0-2]</b></p>	<p><b>Critical evaluation</b></p> <ul style="list-style-type: none"> <li>• Give an evaluation of the finished product with reference to the specification.</li> <li>• Show superficial testing and reflect on how to improve the product.</li> <li>• There will be some use of specialist terms, although these may not always be used appropriately.</li> <li>• The information will be presented for the most part in a structured format.</li> <li>• There may be occasional errors in spelling, punctuation and grammar.</li> </ul> <p style="text-align: right;"><b>[3-5]</b></p>	<p><b>Critical evaluation</b></p> <ul style="list-style-type: none"> <li>• Critically evaluate the finished product against the specification. (AO3)</li> <li>• Undertake detailed testing; present meaningful conclusions leading to proposals for modifications to improve the prototype product. (AO3)</li> <li>• Specialist terms will be used appropriately and correctly.</li> <li>• The information will be presented in a structured format.</li> <li>• The candidate can demonstrate the accurate use of spelling, punctuation and grammar.</li> </ul> <p style="text-align: right;"><b>[6-8]</b></p>



# Appendix C: Controlled Assessment Themes

## – Unit A511 and Unit A513

### Unit A511

The task for this unit is for the candidate to produce a prototype product, capable of being evaluated, and a concise portfolio of work to support the designing and modelling process.

Candidates **must** select one of the following themes as a starting point for the task.

Centres are permitted to contextualise the theme and starting point appropriately to reflect centre or community resources, and access to local business and industry that may add realism to the candidates' work.

Teachers are required to ensure that candidates do not pursue the same 'theme' for their work as submitted or intended for submission for Unit A513.

Teachers must mark the task using the marking criteria provided in Appendix B (Unit A511) of this specification.

In order to design and make their prototype product skilfully, candidates should refer to the content of Unit A514 and use designing, planning, making, materials, tools, equipment and process as appropriate.

Theme	Starting point
Model vehicles	Drive systems, chassis and steering, electronic control. Separate systems within the vehicle can be assigned to individual team members.
Animated charity boxes	Providing dynamic visual/audible feedback to the user when money is inserted.
Animated movement	Mechanical models which climb, swim or walk; they can also be used in competitions.
Travel	Games and entertainment for use during travel.
'Flash from trash'	Scrap-heap challenge, re-use materials to revive and refresh a product from another era. Could also be used with vehicles or mechanical movement.
Sport	Timing devices, count down and data collection to improve personal or team performance.
Security	Personal security devices, locking devices, alarms.
Weather	Recording temperature, sunlight, rainfall, detecting black-ice , providing greenhouse information.
Music	Musical instruments, tuning devices.
Numbers	Improving and developing board game, random number generator, counting devices.
Holding devices	Clamping materials when using power tools.
Test rigs	Testing wear in a mechanism eg drawer runners
Transport of goods	Conveyor control systems, sorting systems, moving heavy loads.

## Unit A513

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The task for this unit is for the candidate to design and manufacture a product. The starting point for this task **must** be selected from a theme set by OCR and listed below.

Centres are permitted to contextualise the theme and starting point appropriately to reflect centre or community resources, and access to local business and industry that may add realism to the candidates' work.

The task can be linked to a candidate's interest or such other influences as competitions, commerce or the community.

Selection of an appropriate theme for the task will be made by candidate and centre, taking account of constraints relating to resources and time available for completion of the task.

Teachers are required to ensure that candidates do not pursue the same 'theme' for their work as submitted or intended for submission for Unit A511.

Teachers must mark the task using the marking criteria provided in Appendix B (Unit A513) of this specification.

In order to design and make their prototype product skilfully, candidates should refer to the content of Unit A514 and use designing, planning, making, materials, tools, equipment and process as appropriate.

Theme	Starting point
Timers	A variable timer to be used with games of skill where each competitor must have a set time (the output must clearly indicate the end of the time period).
Alarms	An alarm to warn of tampering with a sports bag, personal security alarm. (A suitable trigger is required; discrete components or a PIC chip could be used).
4 x 4 Competition vehicle	This multi-part project offers opportunities for teamwork with a number of separate tasks. Tasks could involve mechanisms, control systems or electronics.
Robotics competition	Movement robots can be a combination of electronics and mechanisms and pneumatics and could involve a small teams.
Animated movement	Animated figures are a point of interest, mechanical and pneumatic models which climb, walk or swim, can also be used in a competition.
Charity boxes	Opportunities for mechanisms and electronics. The control system is the main part, various inputs and outputs are possible.
Sustainability	How 'appropriate technology' solutions can be applied in developing countries for moving loads/lifting loads.
Environment	How people react with the area they live in. Needs and problems for living. Encouraging responsible use of resources.
Music	Musical instruments, tuning devices.
Games and puzzles	For developing skills or for amusement.
Lighting	For entertainment or soothing effects, sound to light, light 'motion'.
Overcoming disability	Systems and devices to assist the user with a particular disability.
Batch production	Equipment to assist with achieving consistent quality in production.

# Appendix D: Guidance for the Production of Electronic Controlled Assessment

The materials produced for Controlled Assessment in Units A511 and A513 form a Controlled Assessment portfolio, stored electronically.

## Structure for evidence

A Controlled Assessment portfolio is a collection of folders and files containing the candidate's evidence. Folders should be organised in a structured way so that the evidence can be accessed easily by a teacher or moderator. This structure is commonly known as a folder tree. It would be helpful if the location of particular evidence is made clear by naming each file and folder appropriately and by use of an index, called 'Home Page'.

There should be a top level folder detailing the candidate's centre number, candidate number, surname and forename, together with the Unit code, eg A511, so that the portfolio is clearly identified as the work of one candidate.

Each candidate produces evidence for the Controlled Assessment. The evidence for each element of the Controlled Assessment should be contained within a separate folder within the portfolio. Each of these folders is likely to contain separate files.

Each candidate's Controlled Assessment portfolio should be stored in a secure area on the centre network. Prior to submitting the Controlled Assessment portfolio to OCR, the centre should add a folder to the folder tree containing Controlled Assessment and summary forms.

## Data formats for evidence

In order to minimise software and hardware compatibility issues, it will be necessary to save candidates' work using an appropriate file format.

Candidates must use formats appropriate to the evidence that they are providing and appropriate to viewing for assessment and moderation. Open file formats or proprietary formats for which a downloadable reader or player is available are acceptable. Where this is not available, the file format is not acceptable.

Electronic Controlled Assessment is designed to give candidates an opportunity to demonstrate what they know, understand and can do using current technology. Candidates do not gain marks for using more sophisticated formats or for using a range of formats.

Evidence submitted is likely to be in the form of wordprocessed documents, PowerPoint presentations, digital photos and digital video.

To ensure compatibility, all files submitted must be in the formats listed below. Where new formats become available that might be acceptable, OCR will provide further guidance. OCR advises against changing the file format that the document was originally created in. It is the centre's responsibility to ensure that the electronic portfolios submitted for moderation are accessible to the moderator and fully represent the evidence available for each candidate.

## Accepted File Formats

### Movie formats for digital video evidence

MPEG (\*.mpg)

QuickTime movie (\*.mov)

Macromedia Shockwave (\*.aam)

Macromedia Shockwave (\*.dcr)

Flash (\*.swf)

Windows Media File (\*.wmf)

MPEG Video Layer 4 (\*.mp4)

### Audio or sound formats

MPEG Audio Layer 3 (\*.mp3)

### Graphics formats including photographic evidence

JPEG (\*.jpg)

Graphics file (\*.pcx)

MS bitmap (\*.bmp)

GIF images (\*.gif)

### Animation formats

Macromedia Flash (\*.fla)

### Structured markup formats

XML (\*.xml)

### Text formats

Comma Separated Values (.csv)

PDF (.pdf)

Rich text format (.rtf)

Text document (.txt)

### Microsoft Office suite

PowerPoint (.ppt)

Word (.doc)

Excel (.xls)

Visio (.vsd)

Project (.mpp)