



Specification

Edexcel GCSE in Design and Technology: Electronic Products (2EP01)

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This specification is Issue 2. Key changes are sidelined. We will inform centres of any changes to this issue. The latest issue can be found on the Edexcel website: www.edexcel.com

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Introduction

The Edexcel GCSE in Design and Technology: Electronic Products is designed for use in schools and colleges. It is part of a suite of GCSE qualifications offered by Edexcel.

About this specification

Key features and benefits are:

- the qualification is broken down into two units
- detailed unit content for both units
- clearer assessment criteria for the internally assessed unit
- opportunities for students to complete a full design and make task or design one product and make another
- one examination paper that targets grades A* to G (no tiering).

Key subject aims

The Edexcel GCSE in Design and Technology: Electronic Products enables students to:

- actively engage in design and technology
- 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.

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Specification at a glance

The Edexcel GCSE in Design and Technology: Electronic Products comprises of two units.

Terminal assessment requires at least 40 per cent of the overall assessment to be completed at the time of certification.

The first certification opportunity for this qualification will be June 2011.

Unit 1 Creative Design and Make Activities

*Unit code: 5EP01

- Internally assessed
- Availability: June series
- First assessment: June 2010

60% of the total GCSE

Overview of content

- Students can either design and make one product or different products.
- Students will develop skills in researching, designing, reviewing, planning, making and testing and evaluating.

Overview of assessment

- This unit is internally assessed under controlled conditions.
- Students must complete a design and make activity. These activities can be linked (combined design and make) or separate (design one product, manufacture another).
- Centres will choose a task(s) from a range provided by Edexcel (available on our website at the start of each academic year). These tasks can be contextualised to best suit centre-specific circumstances.
- All work, with the exception of research and preparation, must be done under informal supervision. Research and preparation may be completed under limited supervision.
- Students need to complete their designing and making within 40 hours of informal supervision.
- Marking of task(s) will be carried out by teachers and moderated by Edexcel.
- There are eight assessment criteria for designing, and five assessment criteria for making.
- There are a total of 50 raw marks available for the designing and 50 raw marks available for the making. **One** overall raw mark out of 100 is required.
- The first submission of students' work will be in 2010 and in each June series thereafter.

*See *Appendix 3* for a description of this code and all other codes relevant to this qualification.

Unit 2**Knowledge and Understanding of Electronic Products*****Unit code: 5EP02**

- Externally assessed
- Availability: June series
- First assessment: June 2010

40% of the total GCSE**Overview of content**

- Students will develop knowledge and understanding of a wide range of materials and processes used in design and technology.
- Students will learn about industrial and commercial practices and the importance of quality checks, and the health and safety issues that have to be considered at all times.

The knowledge and understanding students develop in this unit can be applied easily to *Unit 1: Creative Design and Make Activities*.

Overview of assessment

- This unit is assessed through a 1-hour and 30-minute examination paper set and marked by Edexcel.
- The examination paper will be a question and answer booklet and all questions are compulsory.
- The examination paper will consist of multiple-choice, short-answer and extended-writing questions.
- The total number of raw marks available is 80.
- The first examination will be in 2010 and will be available in each June series thereafter.

*See *Appendix 3* for a description of this code and all other codes relevant to this qualification.

A Qualification content

Knowledge and understanding

This Edexcel GCSE in Design and Technology: Electronic Products requires students to demonstrate application and understanding of:

- materials and components
- industrial and commercial processes
- analysing products
- designing products
- technology
- sustainability
- ethical design and manufacture.

Skills

This Edexcel GCSE in Design and Technology: Electronic Products requires students to:

- design creatively
- make products
- apply systems and control, computer-aided design/ computer-aided manufacturing (CAD/CAM), digital media and new technologies (where appropriate)
- analyse and evaluate processes and products.

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Unit 1 Creative Design and Make Activities

Overview

Content overview

Creativity is a fundamental part of design and technology. Many designers believe the quality of the initial idea and thought-provoking, innovative design to be cornerstones of every successful product. The creative design and make activities within this unit seek to develop creativity and confidence in a student's ability to think, question, explore, create and communicate. Combining knowledge and understanding with practical skills, these activities are intended to provide breadth in creative learning and depth in the application of practical and transferable skills.

Assessment overview

- This unit is internally assessed under controlled conditions.
- Students must complete a design and make activity. These activities can be linked (combined design and make) or separate (design one product, manufacture another).
- Centres will choose a task(s) from a range provided by Edexcel (available on our website at the start of each academic year). These tasks can be contextualised to best suit centre-specific circumstances. Tasks will be reviewed every two years.
- Students can undertake a design activity from one task and a make activity from a different task if following a separate design and make activity approach.
- All work, with the exception of research and preparation, must be carried out under informal supervision. Research and preparation may be completed under limited supervision.
- Students need to complete their designing and making within 40 hours of informal supervision time.
- Marking of task(s) will be carried out by teachers and moderated by Edexcel.
- There are eight assessment criteria for designing and five assessment criteria for making.
- There are a total of 50 raw marks available for the designing and 50 raw marks available for the making. **One** overall raw mark out of 100 is required.
- The first submission of students' work will be in 2010 and in each June series thereafter.

Product definition

The emphasis on electronic products work should be the knowledge and understanding related to the technology involved. Evidence of this should be present throughout the design folder. Design and development of the casing should be of secondary importance.

As a general guide, students should divide their efforts in a ratio of about 60:40 or 70:30 in favour of the technological content of their work.

Suggested timings

Design		
Stage	Tasks	Suggested times
1. Investigate	1.1 Analysing the brief	1 hour
	1.2 Research	3 hours
	1.3 Specification	1 hour
2. Design	2.1 Initial ideas	5–6 hours
	2.2 Review	1 hour
	2.3 Communication	Evidenced throughout
3. Develop	3.1 Development	5–6 hours
	3.2 Final design	1–2 hours

Make		
Stage	Tasks	Suggested times
4. Plan	4.1 Production plan	1–2 hours
5. Make	5.1 Quality of manufacture	16 hours
	5.2 Quality of outcome	
	5.3 Health and safety	Evidenced throughout
6. Test and evaluate	6.1 Testing and evaluation	1–2 hours

Controlled conditions

Development of the student's design folder and manufacture of the product(s) must take place under controlled conditions. Students will be supervised by a teacher at all times.

Students' work must be collected in at the end of the lesson and handed back at the beginning of the next lesson. Students must produce their work individually.

Levels of control

Controlled assessment has levels of control for task setting, task taking and task marking. For design and technology these are as follows.

Task setting – high level of control

Tasks will be set by Edexcel. Centres will choose from a list available on our website in September at the start of each academic year. Tasks will be reviewed every two years.

Centres can contextualise the task(s) to best suit their specific circumstances, which includes the availability of and access to resources.

Students can undertake a design activity from one task and a make activity from a different task if following a separate design and make activity approach.

Task taking – medium level of control

All work, with the exception of research and preparation, must be carried out under informal supervision. Research and preparation may be completed under limited supervision.

Task marking – medium level of control

Marking of tasks will be carried out by teachers and moderated by Edexcel.

Feedback control

Teachers are allowed to provide regular, formative feedback throughout the creative design process. Student progression should be supported by the centre's own Assessment for Learning (AFL) strategies.

Demonstrations of practical activities are allowed in order to develop knowledge, understanding and skills and to identify health and safety issues relating to specific tools, equipment and processes.

Collaboration control

Where group work is carried out, evidence of individual contributions must be clearly identified and recorded.

Resources

Access to resources is determined by those available to the centre.

Quality of written communication

Quality of written communication (QWC) will be assessed throughout the student's design folder. This will assess students on their ability to organise information clearly and coherently, using specialist vocabulary when appropriate.

Detailed unit content

Design activity

Students will have the opportunity to follow the creative design process to produce a final design proposal that fully meets the requirements of an identified user group. The brief can be determined by the individual student or set by the teacher, for example as part of 'real world' design experience in partnership with a local company.

Design briefs **must** be derived from the chosen Edexcel task(s).

Stage 1 Investigate

Stage 1.1 Analysing the brief

Students will be assessed on their ability to:

- analyse their design brief in enough detail to be able to clarify design needs. This will involve analysis of key words and phrases that help in understanding the issues related to the chosen/given design task.

Stage 1.2 Research

Students will be assessed on their ability to:

- present selective and focused research that addresses the needs identified when analysing the brief. Students should be discouraged from presenting unnecessary research or 'padding'
- use product disassembly in order to analyse a relevant, existing product's performance, materials and components, processes, quality and sustainability issues. Product analysis is an ideal focused research activity as it enables students to understand the work of professional designers and uncover the problems that they had to solve
- apply findings from product analysis and research to inform their own specification criteria. Students should be able to make connections between existing products and their own potential product.

Stage 1.3 Specification

Students will be assessed on their ability to:

- produce realistic, technical, measurable specification points which address some issues of sustainability for their own product. The specification is an extremely important document as it focuses the designer and enables them to review their design ideas as they progress
- justify their specification points using findings from their research. Each specification point needs to be fully justified and not simply a statement.

Stage 2 Design**Stage 2.1** Initial ideas

Students will be assessed on their ability to:

- present alternative initial design ideas that are realistic, workable and detailed. This is the opportunity for students to demonstrate their creativity and flair for design. A wide range of different initial design ideas should be explored
- demonstrate their understanding of materials, processes and techniques applicable to their initial design ideas. Annotation should clearly show students' knowledge and understanding of workshop or industrial applications relevant to each initial design idea
- apply their research findings to their initial design ideas. Research should not be a separate section but be applied to initial design ideas where appropriate
- address specification points through their initial design ideas. Annotation should be clearly related to the specification points.

Stage 2.2 Review

Students will be assessed on their ability to:

- present objective evaluative comments against their original specification criteria. Initial design ideas are 'raw' at this stage and it is important to determine which can be developed into workable solutions by testing against specification points
- use user group feedback and issues of sustainability to evaluate their initial design ideas. All design is concerned with people, and their opinions are extremely useful in gaining another perspective on the further development of ideas.

Stage 2.3 Communication

Students will be assessed on their ability to:

- use a range of communication techniques and media, including ICT and CAD where appropriate, throughout the design section. There are many ways of presenting initial design ideas from thumbnail pencil sketches to computer-generated images and students should not be afraid to experiment
- use communication techniques with precision and accuracy. The quality of design work should enable clear communication of design intentions.

Stage 3 Develop**Stage 3.1** Development

Students will be assessed on their ability to:

- develop their initial design ideas into a single final design proposal that is significantly different, and improved, to any previous initial design idea. Development should refine technical aspects of the product design and not simply focus on cosmetic changes
- use scale modelling, including 2D/3D modelling in traditional materials and/or 3D computer simulations, to test important aspects of the design idea as it progresses. Simple mock-ups or block models can be invaluable in determining whether a design is workable. The use of CAD can reduce the need for several models
- evaluate their ideas against relevant design criteria as they progress. Annotation of developmental sketches and photographic evidence of modelling should address the specification points.

Stage 3.2 Final design

Students will be assessed on their ability to:

- present a final design proposal in an appropriate format that communicates their design intentions. A range of suitable drawing methods could be used including working drawings, exploded drawings or pictorial drawings
- present technical details of materials and/or components, processes and techniques relating to their final design proposal. Final drawings should be clearly annotated and dimensioned so that they can be understood by a third party.

Make activity

For their make activity, students can continue with the same task and manufacture their final design proposal from the design activity or decide to use a new task and manufacture a different product for their make activity. Teachers have the option of giving students a detailed working drawing or set of plans from which to manufacture a suitably demanding product.

Stage 4 Plan**Stage 4.1** Production plan

Students will be assessed on their ability to:

- produce a detailed production plan that considers the stages of manufacture for their product. Charts should clearly communicate the correct order of making and timings. Plans must be forward looking and not retrospective diaries of events
- identify and describe the stages during making where specific quality control procedures should take place. Feedback in charts should state where quality control will take place.

Stage 5 **Make****Stage 5.1** **Quality of manufacture**

Students will be assessed on their ability to:

- attempt a challenging making task involving the manufacture of several different components using a range of materials, equipment, techniques and processes. Students must ensure that their product provides an opportunity to manufacture several different component parts from different materials using different processes
- select tools, equipment and processes, including CAD/CAM where appropriate*, for specific uses. Students should produce a full photographic record of their stages of manufacture showing all the relevant processes in detail
- demonstrate a detailed understanding of the working properties of materials they have selected for a specific use. Students should use their work plan to justify their choices
- demonstrate a wide range of making skills with precision and accuracy. This is an opportunity for students to be rewarded for the range of making skills they demonstrate during the making activity.

*Students should use no more than **50** per cent CAD/CAM in their making activity so that other tools, equipment and processes can be fully evidenced.

Stage 5.2 **Quality of outcome**

Students will be assessed on their ability to:

- produce high-quality components that are accurately assembled and well finished to produce a high-quality product overall. Where products are incomplete, it is the quality of the manufacture of individual components that will gain marks
- produce a completed product that is fully functional as an electronic product. The final product should be fit for purpose and meet the requirements of the original specification or working drawings.

Stage 5.3 Health and safety

Students will be assessed on their ability to:

- demonstrate a high level of safety awareness throughout all stages of manufacture. Teachers will award these marks based on their observations of students during the make activity. No other formal evidence is required.

Stage 6 Test and evaluate**Stage 6.1** Testing and evaluation

Students will be assessed on their ability to:

- devise and carry out a range of suitable tests to check the performance and/or quality of the final product. Tests should be measurable and refer to specification points, if appropriate, to determine the product's fitness for purpose
- evaluate their final product objectively with reference to specification points, user group feedback and sustainability issues. No product is ever perfect so students should discuss the positive and negative aspects of their final product. User group feedback should provide a further perspective.

Assessment criteria

For these tasks teachers must mark students' work using the assessment criteria specified below. Teachers should check that students' work is their own and is not copied from source material without any attempt by students to put the material into their own words.

Design activity (50 marks)

Investigate (15 marks)		
Sub-sections	Descriptor	Mark range
a) Analysing the brief	Level of response not worthy of credit.	0
	Analysis is superficial leading to unclear design needs.	1
	Analysis is limited with some design needs clarified.	2
	Analysis is detailed with most design needs clarified.	3
b) Research	Level of response not worthy of credit.	0
	Research is superficial and does not focus on the design needs identified in the analysis. Analysis of existing products is insufficient to aid the writing of specification criteria.	1-2
	Research is general, focusing on some of the design needs identified in the analysis. Product analysis is used to inform the writing of some specification criteria.	3-4
	Research is selective and focuses on the design needs identified in the analysis. The performance, materials, components, processes, quality and sustainability issues of relevant existing products are explored in sufficient detail to aid the writing of specification criteria.	5-6
c) Specification	Level of response not worthy of credit.	0
	Specification points are superficial and not justified.	1-2
	Some specification points are realistic and measurable. Some specification points are developed from research but are not justified.	3-4
	Most specification points are realistic, technical, measurable and address some issues of sustainability. Specification fully justifies points developed from research.	5-6

Design (20 marks)		
Sub-sections	Descriptor	Mark range
d) Initial ideas	Level of response not worthy of credit.	0
	Alternative design ideas are similar and simplistic. Ideas are superficial and limited research is used. Limited specification points are addressed.	1-4
	Alternative design ideas are realistic and workable. Ideas are detailed and relevant research is used. Ideas address most specification points.	5-8
	Alternative design ideas are realistic, workable and detailed. Ideas demonstrate detailed understanding of materials, processes and techniques and are supported by research information. Ideas address all key specification points.	9-12
e) Review	Level of response not worthy of credit.	0
	General and subjective comments against some specification points. Limited use of user group feedback.	1-2
	Objective evaluative comments, against most specification points, that consider user group feedback and issues of sustainability.	3-4
f) Communication	Level of response not worthy of credit.	0
	Use of a range of communication techniques, including ICT where appropriate, with sufficient skill to convey an understanding of design ideas.	1-2
	Use of a range of communication techniques and media, including ICT and CAD where appropriate, with precision and accuracy.	3-4

Develop (15 marks)		
Sub-sections	Descriptor	Mark range
g) Development	Level of response not worthy of credit.	0
	Developments from alternative design ideas are minor and cosmetic. Simple modelling is used to test an aspect of the final design proposal against a design criterion.	1-3
	Developments are appropriate and use details from alternative design ideas to change, refine and improve the final design proposal. Modelling using traditional materials and/or 3D computer modelling is used to test some aspects of the final design proposal against relevant design criteria.	4-6
	Development is used to produce a final design proposal that is significantly different and improved compared to any previous alternative design ideas. Modelling to scale using traditional materials or 2D and/or 3D computer simulations is used to test important aspects of the final design proposal against relevant design criteria. User group feedback is used in final modifications.	7-9
h) Final design	Level of response not worthy of credit.	0
	Final design proposal includes limited consideration of materials and/or component parts, processes and techniques.	1-2
	Final design proposal includes details of some materials and/or component parts, processes and techniques.	3-4
	Final design proposal includes technical details of all materials and/or component parts, processes and techniques.	5-6

Make activity (50 marks)

Plan (6 marks)		
Sub-sections	Descriptor	Mark range
a) Production plan	Level of response not worthy of credit.	0
	Superficial production plan that outlines some stages of manufacture with limited reference to quality control.	1-2
	Limited production plan that considers the main stages of manufacture with some reference to appropriate forms of quality control.	3-4
	Detailed production plan that considers all stages of manufacture in the correct sequence including specific forms of quality control.	5-6

Make (38 marks)		
Sub-sections	Descriptor	Mark range
b) Quality of manufacture	Level of response not worthy of credit.	0
	Tools, equipment and processes, including CAD/CAM where appropriate, are selected with guidance. Limited understanding of the working properties of materials when selecting to manufacture a product. The task is undemanding. A limited range of skills and processes is used that show little attention to detail in their use.	1–8
	Tools, equipment and processes, including CAD/CAM where appropriate, are selected with some guidance. Some understanding of the working properties of materials when selecting to manufacture a product. The task offers some challenge. A range of skills and processes is used demonstrating attention to detail in their use.	9–16
	Tools, equipment and processes, including CAD/CAM where appropriate, are selected for specific uses independently. An appropriate understanding of the working properties of materials when selecting to manufacture a product. The task is challenging. A wide range of skills and processes is used with precision and accuracy.	17–24
c) Quality of outcome	Level of response not worthy of credit.	0
	Product includes the manufacture of some good quality component parts that remain either unassembled or poorly assembled and finished. Completed product functions poorly.	1–4
	Product includes the manufacture of good quality component parts that are generally well assembled and finished. Completed product functions adequately.	5–8
	Product includes the manufacture of high-quality component parts, accurately assembled and well finished. Completed product is fully functional.	9–12
d) Health and safety	Level of response not worthy of credit.	0
	Demonstrate an awareness of safe working practices for most specific skills and processes.	1
	Demonstrate a high level of safety awareness throughout all aspects of manufacture.	2

Test and evaluate (6 marks)		
Sub-sections	Descriptor	Mark range
e) Testing and evaluation*	Level of response not worthy of credit.	0
	One or more simple tests carried out to check the performance and/or quality of the final product. Evaluative comments are subjective and reference a few specification points superficially. Use of basic language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar used with limited accuracy.	1–2
	A range of tests carried out to check the performance and/or quality of the final product. Evaluative comments are objective and reference most specification points. Use of some design and technology terms and some focus and organisation. Spelling, punctuation and the rules of grammar used with some accuracy. Some spelling errors may still be found.	3–4
	A range of tests carried out to check the performance and/or quality of the final product with justifications. Objective evaluative comments, including user group evaluation, consider the most relevant, measurable specification points in detail, including sustainability issues. Use of a range of appropriate design and technology terms and good focus and organisation. Spelling, punctuation and the rules of grammar used with considerable accuracy.	5–6

* Opportunity for students to be assessed on quality of written communication: strand (iii) — organise information clearly and coherently, using specialist vocabulary when appropriate.

Unit 2 Knowledge and Understanding of Electronic Products

Overview

Content overview

Students will develop knowledge and understanding of a wide range of materials and processes used in design and technology.

Students will learn about industrial and commercial practices and the importance of quality checks, and the health and safety issues that have to be considered at all times.

The knowledge and understanding students develop in this unit can be applied easily to *Unit 1: Creative Design and Make Activities*.

Assessment overview

- This unit is assessed through a 1-hour and 30-minute examination paper set and marked by Edexcel.
- The examination paper will be a question and answer booklet and all questions are compulsory.
- The examination paper will consist of multiple-choice, short-answer and extended-writing questions.
- The total number of raw marks available is 80.
- The first examination will be in 2010 and will be available in each June series thereafter.

Detailed unit content

Topic 1 Materials and components

Topic 1.1 Woods

What students need to learn

Working properties, advantages/disadvantages of the following wood and manufactured board used in the manufacture of electronic product cases:

- pine
- medium density fibreboard (MDF).

Topic 1.2 Metals

What students need to learn

Working properties, advantages/disadvantages of the following metals used in the manufacture of electronic product cases:

- aluminium
- brass
- copper
- mild steel.

Topic 1.3 Plastics

What students need to learn

Working properties, advantages/disadvantages of the following plastics used in the manufacture of electronic product cases:

- high impact polystyrene (HIPS)
- acrylic.

Topic 1.4 Input components**What students need to learn**

Identification, function and application of the following input components used in the production of electronic products:

Sensors

- light dependent resistor (LDR)
- thermistor
- moisture sensor
- piezo electric sensor
- biosensors (conversion of a biological response to an electrical signal)

Switch types

- toggle
- slide
- rocker
- key
- push to make
- push to break
- tilt
- micro
- reed.

Understand the terms and applications of the following switch types:

- single pole single throw (SPST)
- single pole double throw (SPDT)
- double pole double throw (DPDT).

Topic 1.5 Process components**What students need to learn**

Identification, function and application of the following process components used in the production of electronic products:

- transistor
- thyristor
- Darlington Pair Transistors
- field effect transistor (FET)
- carbon nanotubes as semiconductors
- 555 timer in monostable and astable mode
- operational amplifier (Op-Amp) as a comparator.

Topic 1.6 Peripheral Interface Controllers (PICs)**What students need to learn**

How to use flowcharts when programming.

How to switch outputs on/off in response to inputs.

How to use simple routines to control outputs with delays, loops and counts.

Topic 1.7 Logic gates**What students need to learn**

Identify the following logic gates. Construct truth tables for a NOT gate and the following 2-input logic gates:

- AND
- OR
- NAND
- NOR
- XOR.

How to draw logic diagrams using logic gates in combination to solve problems.

Topic 1.8 Output components**What students need to learn**

Identification, function and application of the following components used in electronic products:

- bulbs
- buzzers
- light emitting diodes (LEDs)
- loudspeakers
- motors
- solenoids
- 7-segment display
- LED dot matrix display
- liquid crystal display (LCD).

Topic 1.9 Power sources**What students need to learn**

Function, application and advantages/disadvantages of the following power sources used in electronic products:

- batteries, including rechargeable types
- mains power
- solar power.

Topic 1.10 Resistors**What students need to learn**

Function and application of the following resistor types used in electronic products:

- fixed
- variable.

Related applications:

- Ohm's law to calculate protective resistor values used in series with LEDs
- the resistor colour code to determine resistor values, including tolerance
- calculate the value of resistor networks in series and parallel.

Topic 1.11 Capacitors**What students need to learn**

Function and application of the following components used in electronic products:

- polarised
- non-polarised.

Topic 1.12 Diodes**What students need to learn**

Function and application of the following component used in electronic products:

- diode used as a protection device against back electric and magnetic fields (EMF).

Topic 1.13 Relays**What students need to learn**

Function and application of the following component used in electronic products:

- relay used as an interface between primary and secondary circuits.

Topic 1.14 Units and calculations**What students need to learn**

- Unit of current (amp)
- Unit of resistance (ohm)
- Unit of voltage (volt)
- Unit of capacitance (farad)
- Ohm's Law: $V = I \times R$
- Time period: $T = R \times C$
- Resistors in series: $R_{\text{total}} = R_1 + R_2 + R_3$ etc.
- Resistors in parallel: $R_{\text{total}} = \frac{R_1 \times R_2}{R_1 + R_2}$ or $R^{\text{Total}} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$

Topic 1.15 Circuit construction**What students need to learn**

Application and advantages/disadvantages of the following circuit construction methods:

- prototyping board (breadboard)
- printed circuit board (photo etched)
- stripboard (veroboard).

Topic 1.16 Circuit testing**What students need to learn**

Application and use of the following when testing circuits:

- voltmeter
- ammeter
- multimeter.

Topic 2 Industrial and commercial processes**Topic 2.1 Scale of production****What students need to learn**

Characteristics, application and advantages/disadvantages of the following scales of production in the manufacture of electronic products:

- one-off
- batch
- mass.

Topic 2.2 Forming techniques**What students need to learn**

Characteristics, preparation, processes, application and advantages/disadvantages of the following methods for the batch and mass production of electronic products:

- injection moulding
- vacuum forming
- line bending
- blow moulding (dome blowing).

Topic 2.3 Health and safety**What students need to learn**

How to understand/describe safe working practices.

How to identify workshop hazards and precautions.

Topic 3 Analysing products

Topic 3.1 Specification criteria

What students need to learn

When analysing a product, students should take into account the following specification criteria:

- form — Why is the product shaped/styled as it is?
- function — What is the purpose of the product?
- user requirements — What qualities make the product attractive to potential users?
- performance requirements — What are the technical considerations that must be achieved within the product?
- material and component requirements — How should materials and components perform within the product?
- scale of production and cost — How does the design allow for scale of production and what are the considerations in determining cost?
- sustainability — How does the design allow for environmental considerations?

Topic 3.2 Materials and components

What students need to learn

Students should identify the materials and/or components used in the manufacture of a product, including:

- the properties and qualities of the materials and/or components
- the advantages/disadvantages of the materials and/or components
- justification of the choice of materials and/or components.

Note: materials and components are those referenced in Topic 1.

Topic 3.3 Manufacturing processes**What students need to learn**

Students should identify the processes involved in the manufacture of products, including:

- the stages of the manufacturing process
- the advantages/disadvantages of the manufacturing process
- justification of the choice of manufacturing process.

Note: manufacturing processes are those referenced in Topic 2.

Topic 4 Designing products**Topic 4.1 Specification criteria****What students need to learn**

When designing a product, students should take into account the following specification criteria:

- form — How should the product be shaped/styled?
- function — What is the purpose of the product?
- user requirements — What qualities would make the product attractive to potential users?
- performance requirements — What are the technical considerations that must be achieved within the product?
- material and component requirements — How should materials and components perform within the product?
- scale of production and cost — How will the design allow for scale of production and what are the considerations in determining cost?
- sustainability — How will the design allow for environmental considerations?

Topic 4.2 Designing skills**What students need to learn**

When designing a product, students should be able to respond creatively to design briefs and specification criteria, including:

- clear communication of design intentions using notes and/or sketches
- annotation which relates to the original specification criteria.

Topic 4.3 Application of knowledge and understanding**What students need to learn**

When designing a product, students should be able to apply their knowledge and understanding of a wide range of materials and/or components and manufacturing processes to each design idea, including:

- the properties of materials and/or components
- the advantages/disadvantages of materials and/or components and manufacturing processes
- justification of the choice of materials and/or components and manufacturing processes.

Topic 5 Technology**Topic 5.1** Information and communication technology (ICT)**What students need to learn**

Characteristics, processes, application and advantages/disadvantages of ICT in the design, development, marketing and sale of products including:

- electronic communications between designers, manufacturers, retailers and consumers using email
- electronic point of sale (EPOS) in the retail and manufacture of products
- internet marketing and sales.

Topic 5.2 Digital media and new technology**What students need to learn**

Characteristics, processes, application and advantages/disadvantages of the following digital media and new technology in relation to:

- transfer of data using Bluetooth® wireless personal area networks
- digital television broadcasting systems using high definition (HD) TV
- commercial digital printing for short print runs and large format prints.

Topic 5.3 Computer-aided design/computer-aided manufacturing (CAD/CAM) technology**What students need to learn**

Characteristics, processes, application and advantages/disadvantages of CAD/CAM in the design, development and manufacture of electronic products:

- virtual modelling and testing of circuit and case designs
- PCB track patterns/design layout
- automated component placement (pick and place)
- computer integrated manufacture (CIM)
- computerised testing systems for quality control.

Topic 6 Sustainability**Topic 6.1 Minimising waste production****What students need to learn**

Principles, application, advantages/disadvantages to society and the environment of minimising waste production throughout the product life cycle using the following 4 Rs:

- reduce materials and energy
- reuse materials and products where applicable
- recover energy from waste
- recycle materials and products or use recycled materials.

Topic 6.2 Renewable sources of energy**What students need to learn**

The characteristics, applications and advantages/disadvantages of using the following renewable sources of energy:

- wind energy using turbines and wind farms
- solar energy using solar cells and photovoltaic cells
- biomass converted into biofuels for transportation.

Topic 6.3 Climate change**What students need to learn**

The responsibilities of 'developed' countries in minimising the impact of industrialisation on global warming and climate change including:

- reducing greenhouse gas emissions through the Kyoto Protocol.

Topic 7 Ethical design and manufacture**Topic 7.1 Moral, social and cultural issues****What students need to learn**

The strategy, characteristics, applications and advantages/disadvantages of the following 'value' issues when designing and manufacturing products:

- built-in obsolescence in new products for a 'throwaway' culture
- offshore manufacture of mass-produced products in developing countries by multi-national companies
- tolerance of different cultures to avoid offence.

B Assessment

Assessment summary

Unit 1 is internally assessed under controlled conditions.

Unit 2 is externally assessed through a 1-hour and 30-minute examination paper.

Summary of table of assessment

Unit 1	Creative Design and Make Activities	Unit code: 5EP01
	<ul style="list-style-type: none">• This unit is internally assessed under controlled conditions.• Students must complete a design and make activity. These activities can be linked (combined design and make) or separate (design one product, manufacture another).• Centres will choose a task(s) from a range provided by Edexcel (available on our website at the start of each academic year). These tasks can be contextualised to best suit centre-specific circumstances.• All work, with the exception of research and preparation, must be done under informal supervision. Research and preparation may be completed under limited supervision.• Students need to complete their designing and making within 40 hours of informal supervision.• Marking of task(s) will be carried out by teachers and moderated by Edexcel.• There are eight assessment criteria for designing and five assessment criteria for making.• There are a total of 50 raw marks available for the designing and 50 raw marks available for the making. One overall raw mark out of 100 is required.• The first submission of students' work will be in 2010 and in each June series thereafter.	
Unit 2	Knowledge and Understanding of Electronic Products	Unit code: 5EP02
	<ul style="list-style-type: none">• This unit is assessed through a 1-hour and 30-minute examination paper set and marked by Edexcel.• The examination paper will be a question and answer booklet and all questions are compulsory.• The examination paper will consist of multiple-choice, short-answer and extended-writing questions.• The total number of raw marks available is 80.• The first examination will be in 2010 and will be available in each June series thereafter.	

Assessment Objectives and weightings

	% in GCSE
AO1: Recall, select and communicate their knowledge and understanding in design and technology including its wider effects.	30%
AO2: Apply knowledge, understanding and skills in a variety of contexts and in designing and making products.	53%
AO3: Analyse and evaluate products, including their design and production.	17%
TOTAL	100%

Relationship of Assessment Objectives to units

Unit number	Assessment Objective			
	AO1	AO2	AO3	Total for AO1, AO2 and AO3
Unit 1	6%	45%	9%	60%
Unit 2	24%	8%	8%	40%
Total for GCSE	30%	53%	17%	100%

Entering your students for assessment

Student entry

Details of how to enter students for this qualification can be found in Edexcel's *Information Manual*, a copy is sent to all examinations officers. The information can also be found on Edexcel's website: www.edexcel.com

Forbidden combinations and classification code

Centres should be aware that students 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 performance tables.

Students should be advised 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 students take two GCSE specifications that have different classification codes but have significant overlap of content. Students who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

Access arrangements and special requirements

Edexcel's policy on access arrangements and special considerations for GCE, GCSE, and Entry Level aims to enhance access to the qualifications for students with disabilities and other difficulties (as defined by the Disability Discrimination Act 1995 and the amendments to the Act) without compromising the assessment of skills, knowledge, understanding or competence.

Please see the Edexcel website (www.edexcel.com/sfc) for:

- the Joint Council for Qualifications (JCQ) policy *Access Arrangements and Special Considerations, Regulations and Guidance Relating to Students who are Eligible for Adjustments in Examinations*
- the forms to submit for requests for access arrangements and special considerations
- dates for submission of the forms.

Requests for access arrangements and special considerations must be addressed to:

Special Requirements
Edexcel
One90 High Holborn
London WC1V 7BH

Disability Discrimination Act (DDA)

Please see the Edexcel website (www.edexcel.com/sfc) for information regarding the Disability Discrimination Act.

Controlled assessment

In controlled assessments, control levels are set for three linked processes: task setting, task taking and task marking. The control levels (high, medium or limited dependent on the subject) are set for each process so that the overall level of control secures validity and reliability, provides good manageability for all involved and allows teachers to authenticate the student work confidently.

The summary of the controlled conditions for this specification are shown below.

Summary of conditions for controlled assessment

The development of the student's design folder and the manufacture of the product(s) must take place under controlled conditions. Students will be supervised by a teacher at all times.

Students' work must be collected in at the end of the lesson and handed back at the beginning of the next lesson. Students must produce their work individually.

Controlled assessment has levels of control for task setting, task taking and task marking. For design and technology these are as follows.

Task setting – high level of control

Tasks will be set by Edexcel. Centres will choose from a list available on our website in September at the start of each academic year. Tasks will be reviewed every two years.

Centres can contextualise the task(s) to best suit their specific circumstances, which includes the availability of and access to resources.

Task taking – medium control of control

All work, with the exception of research and preparation, must be carried out under informal supervision. Research and preparation may be completed under limited supervision.

Task marking – medium level of control

Marking of tasks will be carried out by teachers and moderated by Edexcel.

Internal standardisation

Teachers must show clearly how the marks have been awarded in relation to the assessment criteria. If more than one teacher in a centre is marking students' work, there must be a process of internal standardisation to ensure that there is consistent application of the assessment criteria.

Authentication

All students must sign an authentication statement. Statements relating to work not sampled should be held securely in your centre. Those which relate to sampled students must be attached to the work and sent to the moderator. In accordance with a revision to the current Code of Practice, any student unable to provide an authentication statement will receive zero credit for the component. Where credit has been awarded by a centre-assessor to sampled work without an accompanying authentication statement, the moderator will inform Edexcel and the mark adjusted to zero.

Further information

For more information on annotation, authentication, mark submission and moderation procedures, please refer to the *Edexcel GCSE in Design and Technology: Instructions and administrative documentation for internally assessed units* document, which is available on the Edexcel website.

For up-to-date advice on teacher involvement, please refer to the Joint Council for Qualifications (JCQ) *Instructions for conducting coursework/portfolio* document on the JCQ website: www.jcq.org.uk For up-to-date advice on malpractice and plagiarism, please refer to the Joint Council for Qualifications (JCQ) *Suspected Malpractice in Examinations: Policies and Procedures and Instructions for conducting coursework/portfolio* documents on the JCQ website (www.jcq.org.uk).

Assessing your students

The first assessment opportunity for Unit 1 and Unit 2 of this qualification will take place in the June 2010 series and in each following June series for the lifetime of the specification.

Your student assessment opportunities

Unit	June 2010*	June 2011	June 2012	June 2013
Unit 1: Creative Design and Make Activities	✓	✓	✓	✓
Unit 2: Knowledge and Understanding of Electronic Products	✓	✓	✓	✓

*Note that centres may only enter students for one unit in 2010.

Awarding and reporting

The grading, awarding and certification of this qualification will comply with the requirements of the current GCSE/GCE Code of Practice for courses starting in September 2009, which is published by the Qualifications and Curriculum Authority (QCA). The GCSE qualification will be graded and certificated on an eight-grade scale from A* to G. Individual unit results will be reported.

The first certification opportunity for the Edexcel GCSE in Design and Technology: Electronic Products will be 2011.

Students whose level of achievement is below the minimum judged by Edexcel to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Unit results

The minimum uniform marks required for each grade for each unit:

Unit 1

Unit grade	*A	A	B	C	D	E	F	G
Maximum uniform mark = 120	108	96	84	72	60	48	36	24

Students who do not achieve the standard required for a grade G will receive a uniform mark in the range 0–23.

Unit 2

Unit grade	*A	A	B	C	D	E	F	G
Maximum uniform mark = 80	72	64	56	48	40	32	24	16

Students who do not achieve the standard required for a grade G will receive a uniform mark in the range 0–15.

■ ■ Qualification results

The minimum uniform marks required for each grade:

GCSE in Design and Technology: Electronic Products cash-in code: 2EP01

Qualification grade	*A	A	B	C	D	E	F	G
Maximum uniform mark = 200	180	160	140	120	100	80	60	40

Students who do not achieve the standard required for a grade G will receive a uniform mark in the range 0–39.

■ ■ Resitting of units

Students can resit the assessment requirement for an internally and externally unit only once before claiming certification for the qualification. The best available result for each contributing unit will count towards the final grade.

For internally assessed units students will need to retake the entire assessment requirement for that unit.

Students that want to resit after they have completed all the assessment requirements of the course will be required to retake at least 40 per cent of the assessment requirements.

Results of units will be held in Edexcel’s unit bank for as many years as this specification remains available. Once the GCSE qualification has been certificated, all unit results are deemed to be used up at that level. These results cannot be used again towards a further award of the same qualification at the same level.

Language of assessment

Assessment of this specification will be available in English only. Assessment materials will be published in English only and all work submitted for examination and moderation must be produced in English.

Quality of written communication

Students will be assessed on their ability to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and complex subject matter
- organise relevant information clearly and coherently, using specialist vocabulary when appropriate.

Stretch and challenge

Students can be stretched and challenged in all units through the use of different assessment strategies, for example:

- using a variety of stems in questions — such as, evaluate and discuss
- a requirement for extended writing.

Malpractice and plagiarism

For up-to-date advice on malpractice and plagiarism, please refer to the Joint Council for Qualifications *Suspected Malpractice in Examinations: Policies and Procedures* document on the JCQ website www.jcq.org.uk.

Student recruitment

Edexcel's access policy concerning recruitment to our qualifications is that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all students.

Progression

This qualification supports progression to:

- further education, including the GCE in Design and Technology: Product Design, BTEC Firsts and Nationals in Engineering and the 14–19 Diploma
- training or employment.

Grade descriptions

A	<p>Candidates recall, select and communicate detailed knowledge and thorough understanding of design and technology, including its wider effects.</p> <p>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.</p> <p>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.</p>
C	<p>Candidates recall, select and communicate sound knowledge and understanding of design and technology, including its wider effects.</p> <p>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.</p> <p>They review the evidence available, analysing and evaluating some information clearly, and with some accuracy. They make judgements and draw appropriate conclusions.</p>
F	<p>Candidates recall, select and communicate knowledge and understanding of basic aspects of design and technology, including its wider effects.</p> <p>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.</p> <p>They review their evidence and draw basic conclusions.</p>

Edexcel resources

Edexcel aims to provide the most comprehensive support for our qualifications.

For up-to-date information on published resources, please visit www.edexcel.com/gcse2009

Edexcel publications

You can order further copies of the specification and sample assessment materials (SAMs) documents from:

Edexcel Publications
Adamsway
Mansfield
Nottinghamshire NG18 4FN

Telephone: 01623 467467
Fax: 01623 450481
Email: publications@linneydirect.com
Website: www.edexcel.com

Endorsed resources

Edexcel also endorses some additional materials written to support this qualification. Any resources bearing the Edexcel logo have been through a quality assurance process to ensure complete and accurate support for the specification. For up-to-date information about endorsed resources, please visit www.edexcel.com/endorsed.

Please note that while resources are checked at the time of publication, materials may be withdrawn from circulation and website locations may change.

Edexcel support services

Edexcel has a wide range of support services to help you implement this qualification successfully.

ResultsPlus — ResultsPlus is an application launched by Edexcel to help subject teachers, senior management teams, and students by providing detailed analysis of examination performance. Reports that compare performance between subjects, classes, your centre and similar centres can be generated in 'one-click'. Skills maps that show performance according to the specification topic being tested are available for some subjects. For further information about which subjects will be analysed through ResultsPlus, and for information on how to access and use the service, please visit www.edexcel.com/resultsplus

Ask the Expert — Ask the Expert is a new service, launched in 2007, that provides direct email access to senior subject specialists who will be able to answer any questions you might have about this or any other specification. All of our specialists are senior examiners, moderators or verifiers and they will answer your email personally. You can read a biography for all of them and learn more about this unique service on our website at www.edexcel.com/asktheexpert

Ask Edexcel — Ask Edexcel is Edexcel's online question and answer service. You can access it at www.edexcel.com/ask or by going to the main website and selecting the Ask Edexcel menu item on the left.

The service allows you to search through a database of thousands of questions and answers on everything Edexcel offers. If you don't find an answer to your question, you can choose to submit it straight to us. One of our customer services team will log your query, find an answer and send it to you. They'll also consider adding it to the database if appropriate. This way the volume of helpful information that can be accessed via the service is growing all the time.

Examzone — The Examzone site is aimed at students sitting external examinations and gives information on revision, advice from examiners and guidance on results, including re-marking, resitting and progression opportunities. Further services for students — many of which will also be of interest to parents — will be available in the near future. Links to this site can be found on the main homepage at www.examzone.co.uk

Training

A programme of professional development and training courses, covering various aspects of the specification and examination, will be arranged by Edexcel each year on a regional basis. Full details can be obtained from:

Training from Edexcel
Edexcel
One90 High Holborn
London WC1V 7BH

Telephone: 0844 576 0027
Email: trainingbookings@edexcel.com
Website: www.edexcel.com

D Appendices

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Appendix 1 Key skills

Signposting

Key skills (Level 2)	Unit 1	Unit 2
Application of number		
N2.1	✓	
N2.2	✓	
N2.3	✓	
Communication		
C2.1a		✓
C2.1b		✓
C2.2		✓
C2.3		✓
Information and communication technology		
ICT2.1	✓	✓
ICT2.2	✓	✓
ICT2.3	✓	✓
Improving own learning and performance		
LP2.1	✓	
LP2.2	✓	
LP2.3	✓	
Problem solving		
PS2.1	✓	
PS2.2	✓	
PS2.3	✓	
Working with others		
WO2.1		✓
WO2.2		✓
WO2.3		✓

Development suggestions

Please refer to the Edexcel website for key skills development suggestions.

Appendix 2 Wider curriculum**Signposting**

Issue	Unit 1	Unit 2
Spiritual	✓	✓
Moral		✓
Ethical		✓
Social		✓
Cultural	✓	✓
Environmental	✓	✓
European initiatives	✓	
Health and safety	✓	✓
Legislative	✓	✓
Economic	✓	✓
Sustainable	✓	✓

Development suggestions

Issue	Unit	Opportunities for development or internal assessment
Spiritual	Units 1 and 2	<ul style="list-style-type: none"> By confronting moral, cultural or environmental decisions at every stage of design and technology work and through doing the 'right thing', achieving a feeling of wellbeing and spirituality.
Moral	Unit 2	<ul style="list-style-type: none"> Sustainability issues for safeguarding the quality of life for future generations through cleaner design and technology.
Ethical	Unit 2	<ul style="list-style-type: none"> Ethical design and manufacture — the consideration of 'value' issues when designing and manufacturing commercial products.
Social	Unit 2	<ul style="list-style-type: none"> Uses of ICT in the development, manufacture and sale of products in the global marketplace.
Cultural	Units 1 and 2	<ul style="list-style-type: none"> Unit 1: researching the needs of different cultures when analysing the design brief. Unit 2: tolerance of different cultures to avoid offence.
Environmental	Units 1 and 2	<ul style="list-style-type: none"> Unit 1: consideration of 'environmentally friendly' features when designing and making a product. Unit 2: sustainable product design by minimising waste production throughout the life cycle of the product.
Legislative	Units 1 and 2	<ul style="list-style-type: none"> Identify and undertake risk assessments for practical activities according to HSE legislation.
Economic	Units 1 and 2	<ul style="list-style-type: none"> Unit 1: set budgetary constraints when developing a design specification. Unit 2: the economic viability of offshore manufacturing to multinational companies.
Sustainable	Units 1 and 2	<ul style="list-style-type: none"> Unit 1: writing a design specification taking into consideration issues of sustainability that will affect the product design. Unit 2: evaluate the effectiveness of generating electricity in the UK by means of renewable sources of energy.
European initiatives	Unit 1	<ul style="list-style-type: none"> Researching appropriate British and European Standards (BS EN) when constructing a design specification or working with a manufacturing specification.
Health and safety	Units 1 and 2	<ul style="list-style-type: none"> Demonstrate and understand a high level of safety awareness throughout all stages of the manufacture of a product.

Appendix 3 Codes

Type of code	Use of code	Code number
National classification codes	Every qualification is assigned to a national classification code indicating the subject area to which it belongs. Centres should be aware that students 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 performance tables.	9010
National Qualifications Framework (NQF) codes	Each qualification title is allocated a National Qualifications Framework (NQF) code. The NQF code is known as a Qualification Number (QN). This is the code that features in the DfE's Sections 96 and on the LARA as being eligible for 16-18 and 19+ funding, and is to be used for all qualification funding purposes. The QN is the number that will appear on the student's final certification documentation.	The QAN for this qualification is: GCSE — 500/4421/7
Unit codes	Each unit is assigned a unit code. This unit code is used as an entry code to indicate that a student wishes to take the assessment for that unit. Centres will need to use the entry codes only when entering students for their examination.	Unit 1 — 5EP01 Unit 2 — 5EP02
Cash-in codes	The cash-in code is used as an entry code to aggregate the student's unit scores to obtain the overall grade for the qualification. Centres will need to use the entry codes only when entering students for their qualification.	GCSE — 2EP01
Entry codes	The entry codes are used to: <ul style="list-style-type: none"> • enter a student for the assessment of a unit • aggregate the student's unit scores to obtain the overall grade for the qualification. 	Please refer to the <i>Edexcel Information Manual</i> , available on the Edexcel website.