

**OCR GCSE IN DESIGN AND TECHNOLOGY
(RESISTANT MATERIALS)**

1956

Key Features

- Covers National Curriculum Order for KS4 Design and Technology.
- Coursework clearly linked to teaching content requirement.
- A range of suitable tasks for coursework.
- Immediate support from specialist subject officer.
- Short Course and Certificate of Achievement also available.
- Moderation by visit.

Support and In-Service Training for Teachers

- A full programme of In-Service training meetings arranged by the Training and Customer Support Division (telephone 01223 552950).
- Specimen question papers and mark schemes, available from the Publications department (telephone 0870 8706622; fax 0870 8706621).
- Past question papers and mark schemes, available from the Publications department (telephone 0870 8706622; fax 0870 8706621).
- Written advice on coursework proposals.
- A report on the examination, compiled by senior examining personnel after each examination session.
- Individual feedback to each Centre on the moderation of internally assessed work.

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Throughout the specification the following icons are used to signpost teaching and learning opportunities in:

 Citizenship

 ICT

 Key Skills

- CO - Communication
- N - Application of Number
- IT - Information Technology
- WO - Working with Others
- LP - Improving own Learning and Performance
- PS - Problem Solving

OCR GCSE IN DESIGN AND TECHNOLOGY (RESISTANT MATERIALS) 1956

SECTION A: SPECIFICATION SUMMARY

Outline

This revised GCSE specification retains the characteristics of the Design and Technology (Resistant Materials) specification previously offered by OCR.

This revised specification provides a coherent, satisfying and worthwhile course of study for candidates, whether they wish to pursue the study of Design and Technology in the future or whether it will be their last experience of studying the subject.

This specification meets the National Curriculum Order for England (DfEE/QCA 1999) for Design and Technology and the GCSE Subject Criteria (QCA 2000). It provides opportunities for candidates to develop an awareness of the nature and significant importance of Design and Technology in a rapidly changing society. It enables candidates to develop their application of knowledge, skills, and understanding of a Resistant Materials focus within an overall design and make based approach. The specification offers a system of assessment for GCSE based on clear targets and a coherent set of criteria for rewarding positive achievement across grades G-A*. The assessment of candidates includes both practical capability in Design and Technology applied to designing and making a product, and the knowledge and understanding which underpins this capability.

This specification is fundamentally designed to assess a candidate's capability at the end of KS4. It does, however, recognise that appropriate experiences at KS3 are essential if a candidate is to realise his/her full potential. This specification also provides candidates with a path into AS/A Level and GNVQ Manufacturing and Engineering.

TIERS

Grades	Foundation Tier G to C	Higher Tier D to A*
A*	Candidates take Components 1, 3 and 5	Candidates take Components 2, 4 and 5
A		
B		
C		
D		
E		
F		
G		

COMPONENTS

Component	Name	Duration	Weighting
1	Paper 1 (Foundation)	1 hour	20%
2	Paper 2 (Higher)	1 hour 15 mins	20%
3	Paper 3 (Foundation)	1 hour	20%
4	Paper 4 (Higher)	1 hour 15 mins	20%
5	Internal Assessment (Coursework)	40 hours	60%

QUESTION PAPERS

Papers 1, 2, 3 and 4 will test a candidate's knowledge and understanding of Resistant Materials through questions on designing and making. There will be no choice of questions.

Papers 1 and 2 will include a product analysis question based on information contained in the question paper. The focus of this product analysis question will not follow that of the published theme for Papers 3 and 4

Papers 3 and 4 will include a product analysis question, set on a different theme each year. The theme is printed in the specification with further, detailed information provided early in the year of the examination.

INTERNAL ASSESSMENT (COURSEWORK)

Internal Assessment (coursework) will consist of a project where candidates will be expected to design and make a quality Resistant Materials Product.

The project can be linked to a candidate's own interests, industrial practice or the community.

Projects may involve an enterprise activity, where candidates identify an opportunity, design to meet a need, manufacture products and evaluate the whole design and make process.

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

Candidates must consider how technology affects society and their own lives.

ENTRY OPTIONS

All candidates should be entered for 1956 with one of the following option codes:

Option Code	Option	Components
F	Foundation Tier	1, 3, 5
H	Higher Tier	2, 4, 5

SECTION B: GENERAL INFORMATION

1 Introduction

1.1 RATIONALE

The specification aims to prepare candidates to participate in tomorrow's rapidly changing technologies.

The specification calls for candidates to become autonomous and creative problem solvers, as individuals and members of a team. They must look for needs, wants and opportunities and respond to them by developing a range of ideas and making products and systems. This specification combines practical skills with an understanding of aesthetics, social and environmental issues, function and industrial practices. Candidates reflect on and evaluate relevant present and past design and technology, its uses and effects.

The specification seeks to help candidates to become discriminating and informed users and innovators of products. It encourages candidates to think and intervene creatively to improve the quality of life for society.

The specification provides a framework which can be accessed by all candidates with the potential of gaining a GCSE grade G-A*.

OCR has taken great care in the preparation of this specification and assessment material to avoid bias of any kind.

1.2 CERTIFICATION TITLE

This specification will be shown on a certificate as:

OCR GCSE in Design and Technology (Resistant Materials)

1.3 LEVEL OF QUALIFICATION

GCSE Full Course

This qualification is approved by the regulatory authorities (QCA and ACCAC) as part of the National Qualifications Framework for England and Wales.

Candidates who gain grades G to D will have achieved an award at Foundation Level.

Candidates who gain grades C to A* will have achieved an award at Intermediate Level.

1.4 RECOMMENDED PRIOR LEARNING

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.

Candidates entering this course should have achieved a general educational level equivalent to National Curriculum Level 3, or a distinction at Entry Level within the National Qualifications Framework.

1.5 PROGRESSION

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

Many candidates who enter employment with one or more GCSEs would undertake training or further part-time study with the support of their employer.

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

Specifically students who achieve a grade C or above would be well prepared to study AS/A level Design and Technology and GNVQ Manufacturing and Engineering.

1.6 OVERLAP WITH OTHER QUALIFICATIONS

Specifically, two GCSEs at grade G to D or two GCSEs at grade C to A* are equivalent to Part One GNVQ at Foundation and Intermediate Level respectively.

Four GCSEs at grade G to D or four GCSEs at grade C to A* are equivalent to Full award GNVQ at Foundation and Intermediate Level respectively.

The format of this specification is shared with other specifications in the Design and Technology suite. The very nature of designing and making means that processes are similar, however, the content that is examined in the papers and internal assessment of the specification is unique to this specification.

Of a more general nature this specification provides opportunities to promote knowledge and understanding of a wide range of skills, many of which are shared with other subject areas.

Those identified in the National Curriculum Order for England (DfEE/QCA 1999) for Design and Technology are :

- **thinking skills**, identifying relevant sources of information, and developing criteria for designs to guide their thinking;
- **financial capability**, through taking account of the relative cost of materials and components, in relation to their working characteristics and properties when deciding if, when and how to use them;
- **enterprise and entrepreneurial skills**, through identifying an opportunity to design something to meet a specific need, finding out about the work of professional designers and the manufacturing industry and then making and marketing the prototype product, and evaluating the whole process;
- **work-related learning**, through bringing a realistic industrial or commercial perspective to the development of a product in school based design studios or areas, visiting a workplace for hands-on experience related to designing and making, and providing the opportunity for visitors from business to act as product advisers or clients;
- **education for sustainable development**, through developing knowledge and understanding of the principles of sustainable design and production systems, developing skills in creative problem solving and evaluation, and exploring values and ethics in relation to the application of design and technology.

1.7 RESTRICTIONS ON CANDIDATE ENTRIES

Candidates who enter for this GCSE specification **may not** also enter for any other GCSE specification with the certification title “Design and Technology (Resistant Materials)” or “Design and Technology (Industrial Technology)” in the same examination series.

Candidates who enter for this GCSE may however also enter for any GNVQ specification with the certification title GNVQ Manufacturing, GNVQ Engineering, GNVQ C.B.E. in the same examination series. They may also enter for any NVQ qualification.

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

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

The classification code for this specification is 9040.

1.8 CODE OF PRACTICE REQUIREMENTS

These specifications will comply in every respect with the revised Code of Practice requirements for courses starting in September 2001.

1.9 STATUS IN WALES AND NORTHERN IRELAND

This specification has been approved by ACCAC for use by Centres in Wales

Candidates in Wales and Northern Ireland should not be disadvantaged by terms, legislation or aspects of government that are different from those in England. Where such situations might occur, including in the external assessment, the terms used have been selected as neutral, so that candidates may apply whatever is appropriate to their own situation.

OCR provides specifications, assessments and supporting documentation only in English.

Further information on the provision of assessment materials in Welsh and Irish may be obtained from the Information Bureau at OCR (telephone 01223 553998).

2 Specification Aims

The specification requires candidates to demonstrate fully their design and technology capability by combining skills with knowledge and understanding, in order to design and make quality products. The specification allows candidates to acquire and apply knowledge, skills and understanding through:

- (i) analysing and evaluating products and processes;
- (ii) engaging in focussed tasks to develop and demonstrate techniques;
- (iii) engaging in strategies for developing ideas, planning and producing products;
- (iv) considering how past and present design and technology, relevant to a designing and making context, affects society;
- (v) recognising the moral, cultural and environmental issues inherent in design and technology.

The aims of this specification are:

- to encourage candidates to combine their designing and making skills with knowledge and understanding, in order to design and make quality products;
- to promote design and technology capability in candidates through activities which involve a range of contexts, materials, processes and to lead to practical outcomes;
- to give opportunities to develop practical abilities and the confidence to design, make and modify products for identified purposes, selecting and using resources effectively;
- to promote the use of graphic techniques and ICT including computer-aided design (CAD), to generate, develop, model and communicate design proposals;
- to promote the use of computer-aided manufacture (CAM) in single item production and in batch or volume production;
- to encourage the development of candidates' critical and aesthetic abilities, enabling them to evaluate design and technology activity, including their own, in the context of an identified need;
- to encourage the development of candidates' understanding of the needs and values of a range of users; including spiritual, moral, social, and cultural considerations;
- to promote the key skills of communication, application of number, IT, working with others, improving learning and performance and problem solving;
- to encourage the development of candidates' thinking skills, financial capability, enterprise and entrepreneurial skills;
- to encourage the development of candidates' understanding of work-related learning and the principles of sustainable design and production systems;
- to encourage candidates to consider how present and past design and technology, relevant to a designing and making process, affects society;
- to encourage candidates to consider the uses and effects of new technologies and modern materials on product design and manufacture;
- to provide for activities which give candidates opportunities to work both individually and as a member of a team.

Most of these aims are reflected in the assessment objectives, others, due to their very nature, cannot be readily assessed.

3 Assessment Objectives

The assessment objectives are designed to reflect the programme of study for Design and Technology.

Within this specification candidates will need to demonstrate their ability to:

- develop, plan and communicate ideas;
- work with tools, equipment, materials and components to produce quality products;
- evaluate processes and products;
- understand materials and components;
- understand systems and control.

The GCSE Subject Criteria (QCA 2000) sets out three specification Assessment Objectives for the scheme of assessment:

- | | |
|-----|--|
| AO1 | Capability through acquiring and applying knowledge, skills and understanding of materials, components, processes techniques and industrial practice; |
| AO2 | Capability through acquiring and applying knowledge, skills and understanding when designing and making quality products; |
| AO3 | Capability through acquiring and applying knowledge, skills and understanding when evaluating processes and products; and examining the wider effects of design and technology on society. |

Assessment Components 1-4 Terminal Examination papers

These will test candidates' specialist knowledge, skills and understanding of Resistant Materials through questions on the subject content (section 5) outlined in the specification.

Assessment Component 5 Internal Assessment (coursework)

Internal Assessment (coursework) will test the knowledge, skills and understanding necessary to design and make products in the appropriate media. The evidence required to be submitted for this task must include a 3 dimensional product with a concise portfolio and/or appropriate ICT evidence.

Internal assessment will be evaluated against the following six internal assessment objectives: (see guidance Section 7.3.2)

1. identify a need or opportunity that leads to a design brief;
2. conduct research into the design brief which results in a specification;
3. generate possible ideas for a solution;
4. develop the product for manufacture;
5. plan and realise the product;
6. evaluate and test the product.

4 Scheme of Assessment

4.1 TIERS

The scheme of assessment consists of two tiers: Foundation Tier and Higher Tier. Foundation Tier assesses grades G to C and Higher Tier assesses grades D to A*. Candidates must be entered for either the Foundation Tier or the Higher Tier.

Under no circumstances will a candidate entered for the Foundation Tier be awarded a grade higher than grade C. Candidates on the Higher Tier who fail to achieve the minimum mark for the award of a grade D will normally be ungraded. There is however provision for those who narrowly fail to achieve this mark to be awarded a grade E.

Grades	Foundation Tier G to C	Higher Tier D to A*
A*	Candidates take Components 1, 3 and 5	Candidates take Components 2, 4 and 5
A		
B		
C		
D		
E		
F		
G		

4.2 COMPONENTS

Component	Name	Duration	Weighting
1	Paper 1 (Foundation)	1 hour	20%
2	Paper 2 (Higher)	1 hour 15 mins	20%
3	Paper 3 (Foundation)	1 hour	20%
4	Paper 4 (Higher)	1 hour 15 mins	20%
5	Internal Assessment (Coursework)	40 hours	60%

4.3 QUESTION PAPERS

Each question paper will contain five questions reflecting the grades targeted. Responses from candidates will be required in the form of one word, sentences and sketches with supporting notes.

Papers 1 and 2 will include a product analysis question based on information contained in the question paper. The focus of this product analysis question will **not** follow that of the published theme for Papers 3 and 4

Papers 3 and 4 will include a product analysis question, set on a different theme each year. Candidates will need to study this theme in order to answer the product analysis question fully. Research material, scrap books etc cannot be taken into the examination.

The theme for 2003 : Garden Furniture.

Further detailed information will be provided early in 2003.

4.4 WEIGHTING OF ASSESSMENT OBJECTIVES (1, 2, 3)

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

Foundation Tier

Component	AO1	AO2	AO3	Total
1	4%	12%	4%	20%
3	4%	12%	4%	20%
5	12%	36%	12%	60%
Overall	20%	60%	20%	100%

Higher Tier

Component	AO1	AO2	AO3	Total
2	4%	12%	4%	20%
4	4%	12%	4%	20%
5	12%	36%	12%	60%
Overall	20%	60%	20%	100%

4.5 ENTRY OPTIONS

All candidates should be entered for 1956 with one of the following option codes:

Option Code	Title	Components
F	Foundation Tier	1, 3, 5
H	Higher Tier	2, 4, 5

4.6 INTERNAL ASSESSMENT (COURSEWORK)

The Internal Assessment will consist of **one** project where candidates will be expected to design and make a quality product. This project requires a design and make activity related to industrial/commercial practices, and the appropriate application of systems and control.

The product can be linked to a candidates own interests, industrial practice or the community. Projects may involve an enterprise activity, where candidates identify an opportunity, design to meet a need, manufacture products and evaluate the whole design and make process.

Candidates must use appropriate ICT to help with their work, including computer-aided design and manufacture (CAD/CAM) software, control programs, data analysis and ICT based sources for research.

Through their project, candidates must consider how relevant technology affects society and their own lives.

The evidence required to be submitted for this project must include a 3 dimensional product with a concise portfolio and/or appropriate ICT evidence. The whole activity must not exceed 40 hours of work.

If candidates work in groups, each candidate must take responsibility for a uniquely definable aspect of the overall project and undertake unique research, product design, manufacture and evaluation of that project aspect. Each candidate must provide unique evidence for assessment against the six internal assessment objectives with additional evidence in internal assessment objective 6 (evaluation and testing) to indicate the performance of the candidate's design within the context of the performance of the overall project.

Examples of appropriate tasks are given in Section 6.

Full details of the internal assessment objectives for internally assessed work can be found in Section 7.

4.7 ASSESSMENT OF PRESENTATION AND ICT

Overall presentation skills are assessed in the internally assessed component only. Please refer to guidance in Section 7.3.4.

The assessment of this course requires candidates to use ICT through preparing, presenting, and reviewing information as they work on their design ideas, developing models that communicate these ideas, and making products using computer-aided manufacture (CAM).

4.8 DIFFERENTIATION

Differentiation will be achieved by tiered papers in the terminal examination and by task and outcome in the Internal Assessment. The internal assessment tasks undertaken by each candidate should reflect their capabilities. Exemplar tasks will be available. (See Section 6)

4.9 AWARDING OF GRADES

The written papers will have a total weighting of 40% and internal assessment a weighting of 60%.

A candidate's mark for each of the components taken will be combined in the appropriate weighting to give the candidate's total mark for the specification. The candidate's grade will be determined by this total mark.

Candidates achieving less than the minimum mark for grade G will be ungraded.

Candidates on the Higher Tier who fail to achieve the minimum mark for the award of a grade D will normally be ungraded. There is however provision for those who narrowly fail to achieve this mark to be awarded a grade E.

4.10 GRADE DESCRIPTIONS

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by the candidates awarded particular grades. The descriptions must be interpreted in relation to the content specified in Section 5; 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 overall assessment objectives. Shortcomings in some aspects of the assessment may be balanced by better performance in others.

Grade F

When applying their knowledge, skills and understanding to design and make products, candidates:

- draw on and use various sources of information;
- clarify their ideas through discussion, drawing and modelling;
- use their understanding of the characteristics of familiar products when developing and communicating their own ideas;
- work from their own plans, modifying them where appropriate;
- work with a range of tools, materials, equipment, components and processes with some precision;
- check their work as it develops and modify their approach in the light of progress;
- test and evaluate their products, showing that they understand the situations in which their designs will have to function and are aware of resources as a constraint;
- evaluate their use of basic information sources.

Grade C

When applying their knowledge, skills and understanding to design and make products, candidates:

- use a wide range of appropriate sources of information to develop ideas;
- use a range of strategies to develop ideas, responding to information they have identified;
- investigate form, function and production processes and communicate ideas, using appropriate media;
- recognise the needs of users and develop realistic designs;
- produce plans that make use of time and resources to carry out the main stages of making products;
- work with a range of tools, materials, equipment, components and processes, taking account of their characteristics;
- organise their work so that they can carry out processes accurately and consistently, and use tools, equipment, materials and components with precision;
- adapt their methods of manufacture to changing circumstances, providing a sound explanation for any change from the initial specification;
- select appropriate techniques to test and evaluate how their products would perform when used and modify their products in the light of ongoing evaluation to improve their performance;
- evaluate their use of information sources.

Grade A

When applying their knowledge, skills and understanding to design and make products, candidates:

- seek out and use information to help their detailed design thinking, and recognise the needs of a variety of client groups;
- are discriminating in their selection and use of information sources to support their work;
- they use a wide range of strategies to develop appropriate ideas, responding to information they have identified;
- investigate form, function and production processes and communicate ideas using a variety of appropriate media;
- recognise the different needs of a range of users when developing fully realistic designs;
- when planning, they make sound decisions on materials and techniques based on their understanding of the physical properties and working characteristics of materials;
- work from formal plans that make the best use of time and resources;
- work with a range of tools, equipment, materials and components to a high degree of precision;
- make products that are reliable and robust and that fully meet the quality requirements given in the design proposal;
- identify conflicting demands on their design, explain how their ideas address these demands and use this analysis to produce proposals;

- identify a broad range of criteria for evaluating and testing their products, clearly relating their findings to the purpose for which the products were designed and the appropriate use of resources;
- fully evaluate their use of information sources.

SECTION C: SPECIFICATION CONTENT

5 Introduction

During the key stage, candidates should be taught the knowledge, skills and understanding through: (N.C. order reference paragraph number).

- product analysis (6a);
- focused practical tasks that develop a range of techniques, skills, processes and knowledge (6b);
- design and make assignments, which include activities related to industrial practices and the application of systems and control (6c).

This section is set out in column format to help teachers relate the requirements of the specification content with experiences that would be applicable.

Design and Technology, by its very nature, is continually developing. Teachers should be aware of new developments when preparing candidates for this examination.

The subject content in this section will be tested in the terminal examination. In addition candidates must address this content in their project work.

All the subject content in this section applies to the GCSE (Full Course). The content written in *italics* will only be tested in Examination Papers 3 and 4.

5.1 DESIGNING AND MAKING

5.1.1 Developing and writing a design brief (1a)

 C1.2, C2.2; WO1.1, WO1.2, WO2.1; LP2.1, PS2.1

Candidates should be able to:

Range of activities:

(N.C. order reference paragraph number)

- | | |
|--|--|
| (a) provide a detailed description of the design need using various means of communication; | text, drawings, photographs, <i>graphs</i> , <i>media clippings</i> . |
| (b) extract from verbal, visual and statistical information the essential problems to be solved; | life styles, popular activities, media publicity, consideration of information, <i>professional advice and market research</i> to identify the situation and design brief. |
| (c) identify the range of users and the market for which the product is intended; (1b) | questionnaires, surveys, influences of trends, potential market possibilities. |
| (d) develop a design brief for a marketable product | a clear statement of design intention linked to either the candidates own interests, home, industrial practice or the community. |

5.1.2 Drawing up a Specification

 IT1.1; WO1.1, WO1.2, WO2.1; LP1.1; PS1.1

Candidates should be able to:

- (a) examine the intended purpose of the product;
- (b) identify and collect data relevant to the product(s) and its users; (1b)
- (c) consider issues that affect planning;
- (d) identify and evaluate how existing products fulfil the needs of their intended users;
- (e) demonstrate an ability to express the results of research and analysis in the form of a suitable detailed specification;
- (f) consider the capability required to manufacture in batch quantity. (1c)

Range of activities:

observation, consideration of existing products past and present.

i.e. dimensions, anthropometric data, observation, British and European standards eg. ISO, BS, EN, DIN, CE mark.

appropriate environmental *and monetary* costs.

market and product analysis, *market surveys*, in relationship *to moral, social, economic, environmental and cultural* factors.

a written specification.

consideration of possible systems that would control batch production.

5.1.3 Generating Design Proposals

 IT1.2, IT2.1; WO1.1, WO1.2, WO2.1; LP2.2; PS1.2, PS2.1, PS2.2

Candidates should be able to:

- (a) generate and record a range of design proposals suitable for manufacturing in quantity; (1c)
- (b) identify within those proposals the resources needed for the solution to be realised; (1e)
- (c) evaluate their ideas against the specification and modify where necessary;
- (d) consider whether ideas meet the original need; (3a)
- (e) understand the relevance of function and aesthetics;
- (f) use mock-up models to check on the idea feasibility;
- (g) identify, with reasons for selection/rejection, the chosen design proposal (s) for product development;
- (h) use graphic techniques and ICT, including computer-aided design (CAD), to generate, develop, model and communicate design proposal. (1g)

Range of activities:

ideas recorded in a combination of text and graphic techniques.

materials, constructions and processes.

annotated comments about ideas.

compare generated ideas with the design specification criteria.

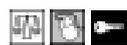
ergonomic, sensory and functional consideration of design proposals.

simple modelling.

evidence to support choice and reasons for rejection.

graphic techniques and computer aided design (CAD) used to generate, *develop, model* and communicate design proposals.

5.1.4 Product Development

 IT2.2, WO1.1, WO1.2, WO2.1, LP1.2, PS2.2

Candidates should be able to:

- (a) conduct testing or trialling to make decisions on materials, production processes and selection of pre-manufactured standard components;
- (b) match materials and components with tools, equipment and processes when deciding how to manufacture the product in quantity;
(1e)
- (c) simulate production by developing a system to control the manufacture of a product individually and/or in batch quality;
(2e)
- (d) be flexible and adaptable in responding to changing circumstances and new opportunities;
(1f)
- (e) use graphic techniques and ICT, including computer-aided design (CAD), to generate, develop, model and communicate design proposal.
(1g)

Range of activities:

appropriate testing to determine: optimum sizes of product, materials, degree of accuracy, production method and appearance.

determine all details needed to manufacture the product in quantity taking notice of the relative costs of materials and components.

appropriate design and use of jigs and/or templates, application of batch production methods; use ICT.

adjusting and modifying parts of the design if required.

graphic techniques and computer aided design (CAD) used to generate, *develop, model* and communicate design proposals.

5.1.5 Product Planning

 WO2.2; LP1.1, LP2.1; PS2.2

Candidates should be able to:

(a) produce and use a detailed plan of work including:

- manufactured items;
- materials;
- equipment;
- tools and processes
- consideration of health and safety issues

against a realistic time schedule.

(1d) (3b)

(b) prepare materials economically allowing for waste and fine finish and use pre-manufactured standard components appropriately.

Range of activities:

a proposed work plan which sets realistic deadlines *and identifies critical points*.

Use ICT to produce flow charts.

efficient material preparation.

5.1.6 Tools and Equipment



Candidates should be able to use a range of tools, equipment and processes effectively and safely, including: (2a)

- (a) proper procedures for the preparation of materials; (4a)
- (b) correct use of marking-out, measuring and testing tools;
- (c) correct use of tools, equipment and components for shaping, forming, cutting, joining, fitting, assembling and finishing;
- (d) safe working practices.

Range of activities:

use of datum edges.

rule, try square, calipers, dividers, scribe, marking and mortise gauges, centre punches and templates.

matching tools and equipment to the materials and processes.

personal protection and the safety of others.

Use of drawing instruments

Candidates should be able to use drawing instruments to achieve a good standard of graphical representation.

access to a minimum range of drawing instruments: drawing board (at least A3 in size) with either T-square or parallel motion, 30°/60° and 45 ° set square, protractor, compasses, 300mm rule, pencils, pens and erasers.

Use of drafting aids

Candidates should be able to use drafting aids to develop good drafting techniques.

access to a minimum range of drafting aids: circle templates, ellipse templates, *flexi curves or french curves*.

Use of colouring media

Candidates should be able to use colouring media to enhance drawings.

access to a minimum range of colouring media: coloured pencils and marker pens.

Use of tools and equipment for model making

Candidates should be able to use tools and equipment to make 2 and 3 dimensional models.

access to scissors, craft knives, safety rules and cutting boards to cut paper, card, foamboard and styrofoam.

5.1.7 Processes

 C1.2; N1.2

Candidates should be able to understand and use:

Range of activities:

- (4b)
- | | |
|---|--|
| (a) work by wasting; | an understanding of hand wasting: sawing, planing, filing, drilling, chiselling. An understanding of <i>machine wasting: power routing, jigsaw, CNC mill.</i> |
| (b) work by deforming; | an understanding of <i>laminating, bending, press moulding, vacuum forming, blow moulding.</i> |
| (c) work by fabricating; | an understanding of temporary joints: screws, nuts and bolts and K-D fittings, <i>tapping and threading.</i> Permanent joints: adhesive, nail, dowel, <i>halving/cross halving, mortise and tenon, butt/rebate, housing, mitre, braze, solder, pop rivet and weld.</i> |
| (d) work by reforming; | an understanding of <i>casting and injection moulding, extrusion.</i> |
| (e) assemble and fit parts correctly; | final adjustments to ensure the product functions. |
| (f) apply surface finishes; | an understanding of self-finishing and applied finishing; <i>polish, stain, varnish, preservative, paint, dip-coat and commercial plating.</i> |
| (g) use appropriate industrial applications when working with familiar materials and processes. | select and use computer controlled machines appropriately to work with a range of resistant materials. An understanding that CAM may be used to make products of repeatable quality.
Make parts of products in batches. |

5.1.8 ICT Applications

  IT1.1, IT1.2, IT2.2, IT2.3

Candidates should:

- (a) understand how CAD/CAM is used in industrial manufacturing;
- (b) recognise that computer systems can control machines and equipment;
- (c) understand how CAD/CAM is used in the manufacture of single items and small batches. (2d)

Range of activities:

books, videos etc, industrial visits.
Links with neighbourhood engineers.

how robotics are used in production lines.

modern computer controlled production methods, self adhesive vinyl sign production.
CNC Machining Centres.

Candidates should use ICT where appropriate to:

- (d) desk top publish; combine written information and graphics, produce a questionnaire.
- (e) produce bar charts, pie charts, flowcharts from data; present results in a graphical form.
- (f) produce graphics; use a paint or draw program to produce original art work including line, texture, colour.
- (g) mould and size text, and/or graphics to suit requirements; produce text in appropriate styles and sizes for presentation.

- (h) aid Design and Technology activities; use ICT appropriately to handle, model or communicate design proposals:
- (i) research from a database, use the internet;
 - (ii) present data in the form of tables or graphics;
 - (iii) *use spreadsheet for costing/modelling*
 - (iv) *Use software to simulate and test the feasibility of a proposed manufacturing system.*
- (i) utilise CAD;
- (j) utilise CAM.
- (1g) create and manipulate a range of 2D/3D Images, producing accurate drawings. engravers, lathes, *machining centres*.

5.1.9 Industrial Applications



Candidates should:

- (a) understand the following commercial production methods:

(2b)

job production;

(2c)

batch production;

repetitive flow;

continual flow process.

- (b) understand the following commercial manufacturing systems:

cell production;

Range of activities:

understand that this involves producing ‘one off’ products. Every item produced is different. It is labour intensive.

understand that this involves the production of a specified quantity of a product. Batches can be repeated as many times as required. This type of production method is flexible and can be used to produce batches of similar products with only a small change to the tooling.

e.g. using templates and jigs.

understand that this involves producing large numbers of identical products for a relatively low cost. The production is usually broken down into sub assemblies of smaller components. This form of mass production can be labour intensive or completely automated depending on the product being manufactured.

understand that this involves uninterrupted 24 hrs/day production of a basic commodity such as steel, chemicals, oil or basic food products. This type of production continues because it is expensive to shut down and then re-start. Only a small workforce is needed to maintain the process.

understand that this is a number of work stations grouped to produce a single component.

in-line assembly;

understand that this is used to mass produce many everyday items especially cars. Many in-line assembly systems are fully automated and only require people to ensure continual flow.

just in time;

this philosophy requires materials, components and sub-assemblies to arrive from other factories 'just in time' for production. Finished products are despatched immediately they are made. This system reduces any storage of stock and allows for changes to the product to be made quickly without the need to use up stock items first.

logistics.

understand that the production of products relies upon the availability of materials and components when required.

(c) understand the packaging, marketing, and advertising implications of a product:

information about the product, consumer preference, legislation, labelling, legal requirements, storage, distribution, cultural and European influences.

(d) understand that control is a necessary part of production and marketing.

procedures to ensure a quality product quality guarantees, consumer rights e.g. ISO 9000.

(2c)

understand that quality control helps to ensure that the customer is satisfied with a product.

understand that a product should meet the criteria listed in the specification.

5.1.10 Good Working Practice

  WO2.2; LP1.1, LP2.2; LP2.3

Candidates should be able to:

Devise strategies to make effective use of available resources to:

- (a) produce process and block diagrams;

- (b) produce time plans and work schedules;
(1d)

(c) carry out testing, evaluation and modification of products.

(3b)

Range of activities:

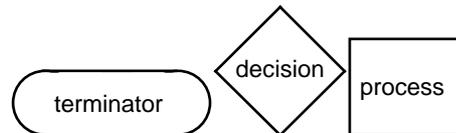
when planning their work candidates should be able to:

identify available materials, components, equipment and facilities.

establish an order for work, *identifying subtasks that need to be done first*.

organise their work to maximise the use of available time and resources.

produce time plans, flow charts *using standard symbols* and the use of appropriate software.



simple trialling of products;
results collected, *charted and analysed*.
Relevant modifications made.

5.1.11 Product Evaluation

 C2.1; WO1.3, WO2.3; LP2.3; PS1.3, PS2.3

Candidates should be able to:

- (a) review their work at critical points and apply quality assurance techniques;
(3b)
- (b) evaluate the proposed product against:
its fitness for purpose;
the design need;
the needs of the intended user(s);
(3c)
- (c) evaluate the proposed product against moral, cultural and environmental issues for the intended user;
- (d) review whether they have used materials and resources appropriately;
- (e) carry out testing, resulting in conclusions that suggest necessary modifications, analyse the performance of the manufacturing control system.

Range of activities:

- regular checks to ensure quality outcome.
- critical evaluation related to initial specification and use of resources.
- sustainable sources of material supply and *disposal*/recycling of redundant products.
- detailed testing with meaningful conclusions.
- proposal for further development, suggest modifications or improvements to:
 - (i) product
 - (ii) jig, template, pattern or computer system.

5.2 KNOWLEDGE AND UNDERSTANDING

5.2.1 Materials and Pre-manufactured Standard Components

(4a, 4b, 4c 4d 4e)

Candidates should be:

- able to identify which material is suitable for a particular situation;
- able to identify the properties that materials (included applied finishes) need to have to fulfil an identified purpose;
- aware of the effects on society of using materials in terms of pollution, waste and recyclability.

Candidates should have a knowledge and understanding of resistant materials (metal, wood, plastic and composites) to include the following:

- **general classification of materials:** i.e. ferrous/non ferrous, hard/softwood, manufactured boards, thermoplastics, *thermosetting plastics and composites*;
- **working properties:** the making of simple comparisons between these materials in relation to strength, hardness, toughness, weight, durability, *plasticity, thermal conductivity* and aesthetic qualities;
- **market forms:** the shapes and sizes, (general, not specific) of sections of these materials and knowledge of their comparative cost;
- **standard pre-manufactured components:** fastenings and fittings.

Metals

(a) Know how to shape and join various types of metals in a variety of forms:

- material preparation – marking out and checking;
- wasting – filing, sawing, cutting, drilling, machining - centre lathe processes, including: facing; parallel turning and centre drilling;
- deforming – bending;
- fabrication - soldering, brazing, *welding*; pop riveting, screws, nuts and bolts;
- *reforming – casting.*

(b) Know how materials can be combined and processed to create more useful properties:

- heat treatment of metal to alter its properties – annealing, harden and tempering.

(c) Know how to prepare for manufacture ensuring economical use of material:

- material preparation – marking out;
- use of appropriate section/size of materials.

- (d) Have an awareness of the importance of self-finishing and applied finishing:
- paint;
 - polishing;
 - *dipcoating*.
- (e) Understand that to achieve the best use of materials and components the interrelationship between material, form and manufacturing processes must be considered carefully:
- matching the material to the desired form;
 - matching the material to the manufacturing process;
 - ensuring minimal waste.
- (f) Understand the use of pre-manufactured standard components:
- make use of standard types and sizes of pre-manufactured standard components;
 - *recognise the economic benefits (in relationship to production) from the use of pre-manufactured standard components across a range of products.*

Wood and Wood Based Materials

- (a) Know how to shape and join various types of timber in a variety of forms including carcass, stool, frame and slab constructions:
- material preparation, sawing, cutting, drilling, sanding, machining;
 - fabrication –
- temporary joints: using screws, K-D fitting, nuts and bolts;
- permanent joints: using adhesives, nails, dowels, butt/rebate, housing, *halving/cross-halving*, mitre, *mortise and tenon*.
- (b) Know how materials can be combined and processed to create more useful properties:
- advantages of using reconstituted materials, manufactured boards.
- (c) Know how to prepare for manufacture ensuring economical use of material:
- use of appropriate section/size of materials.
- (d) Have an awareness of the importance of self-finishing and applied finishing:
- paint;
 - varnish;
 - *polish*;
 - *stain*;
 - *preservative*.

- (e) Understand that to achieve the best use of materials and components the interrelationship between material, form and manufacturing processes are considered carefully:
- matching the material to the desired form;
 - matching the material to the manufacturing process;
 - ensuring minimal waste.
- (f) Understand the use of pre-manufactured standard components:
- use pre-manufactured standard components and parts appropriately;
 - *understand the economic benefits from the use of standard components across a range of products to save design and production time and therefore reduce costs.*

Plastics and Composites

- (a) Know how to shape and join various types of plastics in a variety of forms:
- material preparation – marking out and checking;
 - wasting – filing, sawing, cutting, drilling, machining;
 - fabrication – joining, permanent/temporary;
 - deforming – bending, *laminating*, vacuum forming. Press moulding;
 - reforming – injection moulding, *extrusion*.
- (b) Know how materials can be combined and processed to create more useful properties:
- *use of fillers in resins.*
- (c) Know how to prepare for manufacture ensuring economical use of material:
- material preparation – marking out;
 - use of appropriate type, section and size of materials.
- (d) Have an awareness of the importance of self-finishing and applied finishing:
- polishing;
 - fine finishing (using silicone carbide paper).
- (e) Understand that to achieve the best use of material and components the interrelationship between material, form and manufacturing processes must be carefully considered:
- matching the material to the desired form;
 - matching the material to the manufacturing process;
 - ensuring minimal waste.

- (f) Understand the use of pre-manufactured standard components:
- use pre-manufactured standard components and parts appropriately;
 - *understand the economic benefits from the use of standard components across a range of products to save design and production time and therefore reduce costs.*

‘Smart’ and Modern Materials

- (a) Know that some ‘Smart’ materials respond in a certain way to changes in temperature, light, or pressure:
- shape memory alloy (e.g. nitinol) used to give mechanical movement when a set temperature is reached;
 - low temperature setting plastic (e.g. polymorph) can be moulded or reshaped using hot water.
- (b) *Know how materials can be combined and processed to create more useful properties:*
- *use of modern materials in traditional applications including the use of carbon fibre in fishing rods and kevlar in safety protection helmets;*
 - *use of closed cell foams (Plastazote).*
- (c) Be aware of other ‘Smart’ and modern materials as they become commercially available.

5.2.2 Systems and Control (5a)

Candidates should develop an understanding of control systems, to include:

- the knowledge that a system has three elements; input – process – output;
- the ability to analyse, design and use simple systems;
- *how control can be designed, used and sub-systems interconnected to control production processes including drilling machine, vacuum forming machine;*
- the importance of feedback to control their own batch production system. i.e. jig, former, template, pattern, mould or computer system;
- *an analysis of the effectiveness of the performance of the system.*

Candidates should:

- be able to understand that a mechanism transforms an input motion and force into a desired output motion and force;
- be able to select and use mechanisms to bring about required changes and control movement;
- be able to identify and describe the following types of motion in mechanical systems:
 - (i) linear;
 - (ii) reciprocating;
 - (iii) rotary;
 - (iv) oscillating.

Candidates should be able to identify and describe mechanisms that:

- (i) *turn motion through a right angle i.e. bevel gear, worm and wormwheel;*
- (ii) *reverse the direction of motion i.e. marked spur gears, geartrain;*
- (iii) *change linear motion into rotary motion i.e. rack and pinion;*
- (iv) *change rotary motion into reciprocating motion i.e. cam, crank.*

5.2.3 Products and Applications (6a)

Candidates should be able to carry out a product analysis of commercially manufactured products and their applications. The process should include the following:

- establishing the function and application/s of the product;
- identifying the constituent parts of the product *and their interrelated functions*;
- establishing how the product works *including any scientific principles involved*;
- identifying the materials from which the product is manufactured;
- identifying the manufacturing processes used to make the product;
- *establishing the intended market for the product*;
- *assessing the performance of products against alternative artefacts and solutions*;
- *testing products using existing information regarding materials and processes*.

5.2.4 Quality (2c, 3d, 3c)

Candidates should understand how to distinguish between quality of design and quality of manufacture by drawing on their experience and understanding of existing products and applications including:

- an understanding of procedures that could be set during production to ensure control over quality;
- how far existing products satisfy their needs and fulfil their purpose e.g. a well made child's toy that is of no interest to a child;
- when assembling products, candidates should understand the importance of accuracy;
- the appropriate use of resources and materials in relation to manufacture and maintenance e.g. use of aluminium for ladders and plastics for buckets;
- how the product meets manufacturability and maintenance requirements;
- social, moral, *economic*, *environmental* and aesthetic implications e.g. advantages and disadvantages of mobile phones, consideration of the style of the product, its *disposal* and recycling of materials and components.

5.2.5 Health and Safety (2a)



Candidates should understand health and safety as designers, manufacturers and consumers to include:

- (a) As designers and consumers:
 - correct selection of materials and finishes;
 - safety in terms of function and product maintenance;
 - *workers within the production environment.*

- (b) As workers within the production environment:
 - storage and use of tools and equipment;
 - *materials, chemicals, solvents, finishes;*
 - *flammable and toxic substances.*

- (c) Personal safety:
 - protective wear including eye protection, clothing;
 - machine guards;
 - dust and fume extraction;
 - disposal of waste;
 - use of barrier creams;
 - accident procedure.

- (d) Risk assessment – using information sources:
 - COSHH, vapours given off by some adhesives, finishes;
 - instructions relating to the use of potentially hazardous consumables e.g. ‘Tensol’ cement, impact adhesives, superglue, paints and other finishes;
 - *instructions relating to the use of unfamiliar equipment i.e. portable power tools;*
 - recognition and understanding of safety symbols (UK and European).

- (e) Environmental effects:
 - the disposal of chemicals used to manufacture products;
 - the reduction in the use of chemicals dangerous to the environment including bleaches, CFC’s, toxic materials;
 - the need to dispose of redundant products in a safe and environmentally friendly way;
 - the need to re-cycle materials and pre-manufactured standard components appropriately.

SECTION D COURSEWORK

6 Coursework Tasks

6.1 COURSEWORK PROJECT

Candidates are required to produce a Resistant Materials product that can be marketed. The underlying influence on the project should be that the product will be the first of a batch of 50, realised in school/college with the facilities that are available. The candidate will realise the first, or the prototype of this product.

The evidence required to be submitted for assessment must include a 3 dimensional product with a concise portfolio (including evidence of modelling) and/or appropriate ICT evidence. Centres are reminded that ICT evidence must address the requirements of the six Internal Assessment Objectives. Evidence which does not lead to a finished product can be assessed if it is felt that it represents work appropriate to the focus of the project.

This project will be assessed against the following six internal assessment objectives:

1. identify a need or opportunity that leads to a design brief;
2. conduct research into the design brief which results in a specification;
3. generate possible ideas for a solution;
4. develop the product for manufacture;
5. plan and realise the product;
6. evaluate and test the product.

It is envisaged that the coursework project presented for assessment will represent 40 hours of work for the GCSE Full Course. Some of the work, by its very nature, may be undertaken outside school e.g. research work, testing etc.

6.2 EXEMPLAR COURSEWORK TASKS

Candidates may select one of the following statements as a starting point for the coursework project. Through investigating the statement, candidates can devise their own design brief based on their interests and ability.

It is not compulsory to select an area of design from this list. Teachers and/or candidates can devise their own starting point. OCR coursework consultants are available for advice if required.

In order to contact coursework consultants, Centres should use Coursework Task Proposal forms supplied to Centres in a Coursework Administration Pack or download the form from the OCR website: www.ocr.org.uk

1. Mechanical toys continue to provide interest, humour and fascination for all ages.
2. Puppets have been used as a form of entertainment throughout history. Children gain great pleasure from making the puppet carry out different movements.
3. 'Sit on' or 'push along' toys are very popular with toddlers. They can help develop the child's balance and co-ordination.
4. Puzzles are great fun for the whole family. They can be challenging and competitive.
5. An unusual money storage system may encourage children to save their pocket money.
6. Educational toys can help young children learn important information in a fun and pleasurable way.
7. There is an ever-increasing need for visual aids to help in the understanding of a process or concept.
8. Body adornment continues to be a mode of self-expression and individuality.
9. Mobiles and wind chimes are designed to be visually attractive and help to reduce the stress of modern living.
10. The storage of small items can be a problem in many homes.
11. Photograph frames and mirror frames can enhance interiors and become objects of desire.
12. Many pets become bored and their owners seek activities to amuse them.
13. A garden centre is considering launching a range of products suitable for a small town garden.
14. A city gallery is considering launching a range of products suitable for 'special occasion' presents.
15. Weather vanes / house signs / door furniture, provide decorative and functional features to the outside of the property.
16. Elderly people often have difficulty carrying out every day tasks due to reduced mobility from conditions such as arthritis.
17. Litter is an ever-increasing problem in today's society.
18. Expensive sports equipment is often dumped in the garage or in the corner of the bedroom when not in use.

19. The security of personal possessions can be a problem when camping or caravanning.
20. Displaying examples of student's work has become part of school life. It enhances the environment and provides an area of interest for parents, teachers and pupils. Display systems can be moved or adapted to cater for different demands.
21. The number of reported vehicle thefts is on the increase. It is important to deter the 'would-be-thieves' as well as preventing them driving the vehicle away.
22. During the re-building of motor vehicle, kart and model engines specialist tools are often required.
23. Vehicles occasionally breakdown during a long distance journey and an emergency tool kit can be very helpful.
24. When servicing a motorcycle, mechanics need to make sure that the motorcycle is stable and will not fall over.

6.3 EXPANSION OF AN 'EXEMPLAR COURSEWORK TASK'

Task 1. Mechanical toys continue to provide interest, humour and fascination for all ages.

Internal Assessment Objective 1 - Identification of a need or opportunity leading to a design brief.

- A brief description of the range of mechanical toys available and the situation they are used in.
- The development of a design brief which can develop into the construction of a marketable product. For example :
 - Design and make a mechanical toy based on the theme of sporting activities;
 - Design and make a mechanical toy suitable for young children to play with;
 - Design and make a mechanical to be included in the RSPB gift catalogue;
 - Design and make a humorous mechanical toy.
- A consideration of the needs of the user group for this kind of product.

Internal Assessment Objective 2 - Research into design brief which results in a specification.

- Relevant data to include an identification of the various mechanisms that provide different types of movement. Information about health and safety when designing for specific user groups and an acknowledgement of ergonomic and anthropometric requirements.
- An analysis of similar products already available. Recording factual information and making personal comments about suitability etc.
- An interview or questionnaire to help establish what the user group requires from such a product. - Full analysis and conclusions.
- A specification that lists the design requirements of the product including an acknowledgement that batch production of the final solution must be considered. (N.B. The device, designed to maintain consistency, will be used and evaluated as part of the project.)

Internal Assessment Objective 3 - Generation of design proposals

- A collection of quick annotated sketches showing a range of appropriate solutions.
- Two and / or three-dimensional models to help develop solutions.
- The development of favoured solutions working out the types of mechanisms to achieve the required movements, brief comments about suitable materials, etc.
- An evaluation of the proposed ideas against the original design specification and the final solution fully justified against the needs of the user group.

Internal Assessment Objective 4 - Product development

- An investigation into possible suitable construction materials. Rejection / selection should be based on personal testing or experimentation.
- An investigation into possible construction methods, processes and workshop equipment. Rejection / selection should be fully justified.
- Computer modelling, or fabricating a prototype may help develop the concept and improve the design.
- The size and shape of each component should be decided and recorded. This may take the form of a working drawing.
- An investigation of material costs and availability. An investigation of items that need to be purchased, such as hinges, gears, handles, switches etc.
- The possibilities for batch production should be investigated. Candidates are encouraged to design and make a simple jig, former or template that will be used during the construction process as a system to maintain consistency.

Internal Assessment Objective 5 - Product planning and realisation

- A plan of action showing the order of manufacture and final details of materials, tools and equipment. This is usually in the form of a flow chart. Time charts help to focus the activity and set weekly targets.
- During construction, material should be cut economically. Safe working procedures should be followed and the device produced to aid in the consistency during manufacture should be used.
- Marks are awarded for an appropriate range of skills and techniques used to make a quality product that functions as intended.

Internal Assessment Objective 6 - Evaluation and product testing

- The mechanical toy is evaluated against the original specification.
- The product's fitness for purpose is tested in the situation it was designed for. Individuals from the user group should be given the opportunity to use the product and make comments.
- The success of the planned control system (jig, former, template) for the manufacture of the product is analysed against their production of a single product.
- As a result of the testing, proposals for further development are suggested and explained

7 Regulations for Internal Assessment

7.1 SUPERVISION AND AUTHENTICATION OF COURSEWORK PROJECTS

OCR expects teachers to supervise and guide candidates who are undertaking work which is internally assessed (e.g. coursework project). The degree of teacher guidance in candidates' work will vary according to the work being undertaken. It should be remembered, however, that candidates are required to reach their own judgements and conclusions.

When supervising internally assessed coursework projects, teachers are expected to:

- Offer candidates advice about how best to approach their work.
- Exercise continuing supervision of work in order to monitor progress and to prevent plagiarism.
- Ensure that the work is completed in accordance with the specification requirements and can be assessed in accordance with the internal assessment objectives and procedures.

Internally assessed coursework projects should be completed in the course of normal curriculum time 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 etc. As with all internally assessed work, the teacher must be satisfied that the work submitted for assessment is the candidate's own work.

7.2 PRODUCTION AND PRESENTATION OF INTERNALLY ASSESSED COURSEWORK PROJECT

Candidates must observe certain procedures in the production of internally assessed work.

- Any copied material must be suitably acknowledged.
- Quotations must be clearly marked and a reference provided wherever possible.
- Work submitted for moderation must be marked with the:
 - Centre number
 - Centre name
 - Candidate Number
 - Candidate Name
 - Specification title and code i.e: OCR GCSE Design and Technology (Resistant Materials) 1956.
 - Coursework project title.

7.3 MARKING CRITERIA FOR INTERNALLY ASSESSED WORK

This specification requires candidates to demonstrate fully their design and technology capability. They should combine skills with knowledge and understanding in order to design and make quality products.

The assessment objectives:

- of materials, components, processes, techniques and industrial practise (AO1);
- for designing and making quality products (AO2);
- for evaluating processes and products and examining the wider effects of design and technology on society (AO3);

are assessed, in an integrated way, through the six **Internal Assessment Objectives** shown below.

Internal Assessment Objectives		Specification Assessment Objectives		
		AO1	AO2	AO3
1	Identification of a need or opportunity leading to a design brief		2	2
2	Research into design brief resulting in a specification	2	6	4
3	Generation of design proposals	2	8	2
4	Product development	6	4	2
5	Product planning and realisation	10	40	2
6	Evaluation and testing			8
Total Marks		20	60	20

The weighting of the marks provides an indicator of the time that candidates should spend on each part of the project.

It is envisaged that the coursework project presented for assessment will represent 40 hours work. Some of the work, by its very nature, may be undertaken outside school e.g. research work, testing etc.

7.3.1 Assessment of the Overall Presentation of the Coursework Project

This specification provides for an assessment of the overall presentation of the coursework project. Marks are awarded on the basis of a candidate's overall performance in presenting work throughout the project portfolio. Details are given in Section 7.3.4.

7.3.2 Guidance for Teachers

It is appreciated that for assessment purposes, the Internal Assessment Objectives have been written in a linear form. However, within focus areas of Design and Technology, some stages may interrelate and be cyclical in approach.

This specification requires candidates to produce a Resistant Materials product that can be marketed. The underlying influence on the project should be that the product will be the first of a batch of 50, realised in school/college with the facilities that are available. The candidate will realise the first, or the prototype of this product.

The type of project selected should be challenging, but realistic in terms of resources and time available. Candidates are actively encouraged to think about the needs/requirements of the user group and the situation the product will be used in. It is vital that a design brief is established at the beginning of the process, to enable candidates to focus their research. (Some Centres provide the candidates with a set theme as a starting point, others allow individuals to recognise their own design need/opportunity.)

Having established a design brief, candidates need to extend their understanding of the situation by collecting, documenting and analysing relevant data. Candidates should be encouraged to use ICT where appropriate. Digital cameras, scanned and down loaded images, internet and CD-ROM access can all provide opportunities for candidates to document information. Feedback from the intended user group about the requirements and expectations of the product can be obtained via a survey or in-depth interview with an expert. Product analysis of similar products already available can inform opinions about human interaction, product functions, value for money etc. The design specification provides a clear understanding of all the major design requirements needed to make the product successful. The candidate should acknowledge the considerations for quantity production as part of the specification. Quick initial design sketches can be developed and modelled using CAD. Annotation can provide additional details about possible solutions. The final design selection needs to be discussed and justified against the original design specification. Where appropriate, candidates should consider the use of 'smart' and modern materials.

During the product development section, candidates need to develop their idea towards a final product. They test materials, production methods and surface finishes. The results need to be recorded and decisions justified. Exact sizes and shapes of components are established. Prepared spreadsheets may be used to show the costing for one single item and/or batch of ten etc. Tessellating can show economic use of materials. ICT can be used to test a component design prior to CAM manufacture. 3D modelling tools can create realistic representation of the finished product. Candidates are to design and make a simple device such as a jig, former or template that can be used as part of a system to maintain consistency during the manufacture of their product. The success of this device is assessed during the evaluation report.

Prior to realisation, candidates need to plan the order of manufacture, the processes, tools and equipment to be used. Time plans help to keep the candidate on target. Using a range of skills and techniques, candidates are expected to make a quality product that meets the requirements of the design specification.

The evaluation report provides the opportunity for the candidate to analyse the outcome against the original specification and whether they have used the correct materials, equipment etc. Full product testing will establish the success of the product and consumer/user group opinions will inform suitable modifications and further product development. An evaluation of the system designed to maintain consistency during production would establish its effectiveness and need for further improvements.

7.3.3 Applying the Internal Assessment Objectives to Candidates' Work

Each internal assessment objective has four 'level of response' boxes containing hierarchical statements. Initially a 'best fit' should be established and the mark awarded within the appropriate mark range.

The marks have been broken down into ranges of marks for the hierarchical statements within each level of response box.

This breakdown enables positive marking of a coursework project by allowing the teacher to match statements from any of the level of response boxes against the evidence offered by the candidate. This approach can be applied to each assessment objective using the marks in brackets [] as indicated.

For example when marking internal assessment objective 5, a project may reflect:

Little or no planning	[3]
Has overcome problems as they arise etc.	[6]
With a normal level of supervision, has combined a range of skills and techniques etc.	[9]
The product will exhibit a reasonable standard etc.	[8]
Total Mark	26

Internal Assessment Objective 1

TOTAL MARKS 4

Identification of a Need or Opportunity leading to a Design Brief	Level of Response	Mark Range
<p>Candidates will need to:</p> <ul style="list-style-type: none"> • provide a description of the design need using various means of communication; • identify the range of users and the market for which the product is intended; • develop a design brief for a marketable product. 	<p>A statement of what is to be made.</p>	0-1
	<p>Some consideration of the design need or the intended user/users leading to a design brief.</p>	2
	<p>Consideration of both the design need and the intended user/users leading to a clear design brief of a marketable product</p>	3
	<p>Detailed description of both the design need and user/users leading to a clear and precise design brief of a marketable product.</p>	4
Total		4

Internal Assessment Objective 2

TOTAL MARKS 12

Research into the Design Brief which Results in a Specification	Level of Response		Mark Range	
<p>Candidates will need to:</p> <ul style="list-style-type: none"> examine the intended purpose, form and function of the product; undertake appropriate surveys, identifying and evaluating how existing products fulfill the needs of their intended users; identify and collect data relevant to the product(s) and its users; develop a detailed specification and criteria that includes the capability for batch production. 	<p>Limited research of intended use. Some recognition of existing products. A specification identifying some basic requirements.</p>	<p>[1] [1] [1]</p>	<p>0-3</p>	
	<p>Intended use of product examined with some data identified or collected.</p> <p>Existing products identified with some evaluation.</p> <p>A specification identifying some key features including a suggestion of how more than one could be made.</p>	<p>[2] [2] [2]</p>	<p>4-6</p>	
	<p>Intended use of product examined with data identified and collected.</p> <p>Existing products identified and evaluated considering some of the needs of the intended user/users.</p> <p>A detailed specification containing some reference to a system required to manufacture in batches.</p>	<p>[3] [3] [3]</p>	<p>7-9</p>	
	<p>Intended use of product fully examined with relevant data identified and collected.</p> <p>Existing products identified and fully evaluated against the needs of the intended user/users.</p> <p>Analysis of the research and information sources leading to a detailed design specification that would provide a system to ensure control over the production of the product in batches.</p>	<p>[4] [4] [4]</p>	<p>10-12</p>	
	Total			12

Internal Assessment Objective 3

TOTAL MARKS 12

Generation of Design Proposals	Level of Response		Mark Range	
<p>Candidates will need to:</p> <ul style="list-style-type: none"> generate a range of design proposals; check design proposals against design specification and review and modify them if necessary; identify chosen design proposal for product development; present design solutions using a range of graphic techniques and ICT including computer-aided design (CAD), to generate, develop, model and communicate design proposals. 	<p>One or more solutions proposed.</p> <p>Little or no evaluation.</p> <p>The work displays a low standard of communication techniques.</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p>	<p>0-3</p>	
	<p>Several solutions proposed</p> <p>A cursory evaluation. Unsupported choice of design proposal.</p> <p>Communication will be of a reasonable standard using a limited number of techniques.</p>	<p>[2]</p> <p>[2]</p> <p>[2]</p>	<p>4-6</p>	
	<p>A range of appropriate solutions proposed.</p> <p>Design proposal chosen, supported by clear evaluation.</p> <p>Communication will be of a good standard, using a range of appropriate techniques.</p>	<p>[3]</p> <p>[3]</p> <p>[3]</p>	<p>7-9</p>	
	<p>A wide range of appropriate solutions proposed.</p> <p>Design proposal chosen as a result of detailed evaluation and consideration of the need and fitness for purpose.</p> <p>Communication will be of a high quality, using a wide range of appropriate techniques.</p>	<p>[4]</p> <p>[4]</p> <p>[4]</p>	<p>10-12</p>	
	Total			12

Internal Assessment Objective 4

TOTAL MARKS 12

Product Development	Level of Response		Mark Range
<p>Candidates will need to:</p> <ul style="list-style-type: none"> as a result of investigation, testing or trialling, make reasoned decisions about: <ul style="list-style-type: none"> materials; production methods; pre-manufactured standard components. consider how materials are prepared for manufacture and how pre-manufactured standard components are used; 	Some materials and production methods identified.	[1]	0-3
	Has attempted to model part of final solution.	[1]	
	Limited details given for final solution.	[1]	
<ul style="list-style-type: none"> by modelling, apply test procedures ensuring the product meets the original design brief and its fitness for purpose; consider when developing the product, the implications for quantity manufacture of: <ul style="list-style-type: none"> (i) materials and components; (ii) tools, equipment and processes; (iii) critical dimensions and tolerances. 	As a result of investigations some decisions made about materials, production methods function and pre-manufactured items.	[2]	4-6
	Has used modelling to check that the product meets the design brief.	[2]	
<ul style="list-style-type: none"> develop a control system to be used in the manufacture of their product; be flexible and adaptable in responding to changing circumstances and new opportunities; make any necessary modifications to the chosen design; give details of the final design including a final product specification; 	Some testing and trialling resulting in decisions about materials, production methods and pre-manufactured items.	[3]	7-9
	Used modelling and testing to ensure that the product meets the design brief.	[3]	
	Most details given about final product and the control system needed to produce the product in quantity.	[3]	
<ul style="list-style-type: none"> present design solutions using a range of graphic techniques and ICT including computer-aided design (CAD), to develop, model and communicate design proposals. 	Appropriate testing and trialling resulting in reasoned decisions about materials, production methods and pre-manufactured items.	[4]	10-12
	Has used modelling and test procedures to identify any necessary modifications and to ensure the product meets the design brief.	[4]	
	Full details about the final product and the control system needed to produce the product in quantity.	[4]	
Total			12

Internal Assessment Objective 5

TOTAL MARKS 52

Product Planning and Realisation	Level of Response		Mark Range		
<p>Candidates will need to:</p> <ul style="list-style-type: none"> produce a plan of action which considers: materials, pre-manufactured items, equipment, processes and health and safety issues against an order of work and the need to make products that match the design specification; select and use tools, equipment and processes effectively and safely; economically prepare materials/ pre-manufactured items for production, allowing for waste and fine finish; complete a quality outcome suitable for the intended user or users, ensure that their outcome functions effectively; be prepared to adapt working procedures in response to changing circumstances; use a range of skills and techniques appropriate to the task; where appropriate apply a range of industrial techniques when working with familiar materials and processes. 	<p>Little or no planning.</p> <p>Has used a limited range of materials, tools and equipment</p> <p>With frequent prompting uses basic skills and techniques appropriate to the task. Little understanding of safe working practices.</p> <p>The product will exhibit a low standard of outcome and may not be successfully completed.</p>	<p>[3]</p> <p>[3]</p> <p>[3]</p> <p>[4]</p>	<p>0-13</p>		
	<p>Planning will have been restricted to the immediate task and will have relied on prompting.</p> <p>Has overcome problems as they arise using appropriate materials, tools and equipment.</p> <p>With some guidance has used a range of skills and techniques appropriate to the task. Reasonable understanding of safe working procedures.</p> <p>The product will exhibit a reasonable standard of outcome, be mainly complete and will satisfy the specification with a limited degree of success.</p>	<p>[6]</p> <p>[6]</p> <p>[6]</p> <p>[8]</p>		<p>14-26</p>	
	<p>Most of the realisation will have been planned in advance</p> <p>Has made economic and efficient use of materials, tools and equipment modifying the application of these if appropriate.</p> <p>With a normal level of supervision, has combined a range of skills and techniques appropriate to the task. Good understanding of safe working procedures.</p> <p>The product will exhibit a good standard of outcome, will be complete and will function as intended.</p>	<p>[9]</p> <p>[9]</p> <p>[9]</p> <p>[12]</p>			<p>27-39</p>
	<p>The realisation will have been thoroughly planned to specify an effective order for the sequence of operations.</p> <p>Resourceful and adaptable with materials, tools and equipment and to a high degree of precision.</p> <p>Has independently combined a range of skills and techniques appropriate to the task. High understanding of safe working procedures.</p> <p>The product will be completed to a high quality and will fully meet the requirements of the final product specification.</p>	<p>[12]</p> <p>[12]</p> <p>[12]</p> <p>[16]</p>			
	Total			52	

Internal Assessment Objective 6

TOTAL MARKS 8

Evaluation and Testing	Level of Response		Mark Range
<p>Candidates will need to:</p> <ul style="list-style-type: none"> evaluate their products to ensure that they are of a suitable quality for intended users; carry out testing, resulting in reasoned conclusions that suggest any necessary modifications to improve the product; review whether they have used resources appropriately e.g. time, materials, equipment and production methods; analyse the performance of their manufacturing control system in the production of the prototype. 	<p>Relevant un-supported comment with some reference to the specification.</p>	[1]	0-2
	<p>No evidence of testing</p>	[1]	
	<p>Some supported comment with reference to the specification and use of resources.</p>	[2]	3-4
	<p>Superficial testing with a conclusion.</p>	[2]	
	<p>Relevant comments with reference to the specification and use of resources.</p>	[3]	5-6
	<p>Relevant testing with few conclusions, leading to a possible modification or improvement of product and/or system designed to control manufacture.</p>	[3]	
	<p>Critical evaluation related to the specification and use of resources</p>	[4]	7-8
	<p>Detailed testing with meaningful conclusions leading to proposals for further development, modification or improvements of product and system designed to control manufacture.</p>	[4]	
Total			8

7.3.4 Assessment of the overall presentation of the coursework project

An assessment of the overall presentation of the project is provided for the internally assessed component of this specification.

Marks are awarded on the basis of a candidate's overall performance in presenting work throughout the project portfolio. Performance criteria are given below to assist with the allocation of marks.

Teachers should first assess the candidate's project portfolio against the six **Internal Assessment Objectives**. The performance criteria for presentation should then be applied, and marked according to the table given below.

Performance Criteria	Mark Range
Below threshold performance	0
Threshold performance Candidates present their ideas with reasonable care in a format that can be followed.	1
Intermediate performance Candidates present their ideas with care in an appropriate sequence.	2-3
High performance Candidates present their ideas adeptly in a logical and concise way.	4-5

7.4 MODERATION

All internally assessed work is marked by the teacher and internally standardised by the Centre. Marks are then submitted to OCR by a specified date, after which moderation takes place in accordance with OCR procedures. The purpose of moderation is to ensure that the standard of the award of marks for internally assessed 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 internal assessment objectives defined in Section 7.3.

Where it is not clear within a project folder, by the candidate's own presentation of work, where the marks have been awarded, annotation must be carried out by the person marking the work.

7.5 MINIMUM REQUIREMENTS FOR INTERNALLY ASSESSED WORK

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.

SECTION E: FURTHER INFORMATION

8 Opportunities for Teaching

8.1 ICT

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 Resistant Materials.

The assessment of this course requires candidates to use ICT through preparing, presenting, and reviewing information as they work on their design ideas, developing models that communicate these ideas, and making products using computer-aided manufacture (CAM).

This section offers guidance on opportunities for using ICT during the course. These opportunities are also indicated within the content of Section C by a  symbol. Such opportunities may or may not contribute to the provision of evidence for IT Key Skills. Where such opportunities do contribute, they are identified by the use of the  symbol.

ICT Application	Opportunities for Using ICT during the Course
Database	Sections 5.1.1, 5.1.8, 5.1.11
Internet	Sections 5.1.2, 5.1.8
Word Processing	Sections 5.1.2, 5.1.8, 5.1.11
Spreadsheet	Sections 5.1.5, 5.1.8
CAD	Sections 5.1.3, 5.1.4, 5.1.6, 5.1.8
CAM	Sections 5.1.8, 5.1.9, 5.1.10

8.2 CITIZENSHIP

From September 2002, the National Curriculum for England at KS4 includes a mandatory programme of study for Citizenship. Parts of this programme of study may be delivered through an appropriate treatment of other subjects.

This section offers guidance on opportunities for developing knowledge, skills and understanding of citizenship issues during the course. These opportunities are also indicated within the content of Section 5 by a  symbol.

Citizenship	Opportunities for Teaching Citizenship Issues during the Course
Consider the needs of others	Section 5.1.1
Consider issues surrounding a particular product and its surroundings	Section 5.1.2
Seek opinions of others and be flexible and adaptable in responding to their needs	Sections 5.1.3/4
Consider the need to work together as a team	Section 5.1.9
Seek the opinions of others	Section 5.1.11
Consider the health and safety of others	Section 5.2.5

8.3 SPIRITUAL, MORAL, ETHICAL, SOCIAL AND CULTURAL ISSUES

The specification provides opportunities to promote:

- spiritual development, through helping pupils recognise their own creativity and the creativity of others in finding solutions to problems, and through recognising the tension between material and non-material needs;
- moral development, through helping pupils to reflect on how technology affects the environment so they can make informed choices when designing and making and through discussing the moral dilemmas posed by introducing new technologies within different value systems and the advantages and disadvantages of new technology to local, national and global communities;
- social development, through helping pupils recognise the need to consider the views of others when discussing design ideas;
- cultural development, through exploring the contribution of products to the quality of life within different cultures, and through valuing and reflecting on the responses of people from other cultures to design solutions.

8.4 HEALTH, SAFETY AND ENVIRONMENTAL ISSUES

OCR has taken account of the 1988 Resolution of the Council of the European Community and the Report Environmental Responsibility: An Agenda for Further and Higher Education, 1993 in preparing this specification and associated specimen assessments.

The specification provides opportunities to promote education for sustainable development, through developing knowledge and understanding of the principles of sustainable design and production systems, developing skills in creative problem solving and evaluation, and exploring values and ethics in relation to the application of design and technology.

Whilst candidates will not be specifically assessed in terms of their knowledge and awareness of issues associated with energy usage it is anticipated that, whenever possible, candidates will be encouraged to consider the benefits and drawbacks associated with the use of different sources of energy.

The specification content includes a specific requirement to consider issues associated with health and safety and the environment. See section 5.

8.5 THE EUROPEAN DIMENSION

OCR has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen assessments. European examples should be used where appropriate in the delivery of the subject content. Relevant European legislation is identified within the specification where applicable. See section 5

9 Key Skills

Key Skills are central to successful employment and underpin future success in learning independently. Whilst they are certificated separately, the Key Skills guidance for this qualification has been designed to support the teaching and learning of the content. Opportunities for developing the generic Key Skills of Communication, Application of Number and Information Technology are indicated through the use of a 'key symbol' in Section 5. The wider Key Skills of Working with Others, Problem Solving and Improving Own Learning and Performance may also be developed through the teaching programmes associated with the specification.

The following matrix indicates where coverage exists within the specifications.

	Communication	Application of Number	IT	Working with Others	Improving Own Learning and Performance	Problem Solving
Level 1	✓	✓	✓	✓	✓	✓
Level 2	✓		✓	✓	✓	✓

Detailed opportunities for generating Key Skills evidence through this specification are posted on the OCR website. A summary document for Key Skills coordinators showing ways in which opportunities for Key Skills arise within GCSE courses will be published during 2001.

10 Resources List

At the time of publication of this specification, Heinemann is preparing a textbook and teacher's resource file to accompany this course. It will be endorsed by OCR for use with this specification, subject to OCR's quality assurance procedure before final publication. For further details, please contact either the Design and Technology team at OCR Birmingham Office or Heinemann direct on 01865 311366.

Brian Morris	GCSE Resistant Materials Technology for OCR Student Book	ISBN 0435 41700 2
Brian Morris with Rod Kay	GCSE Resistant Materials Technology for OCR Teacher's Resource File	ISBN 0435 41701 0

11 Arrangements for Candidates with Special Needs

For candidates who are unable to complete the full assessment or whose performance may be adversely affected through no fault of their own, teachers should consult the Inter-Board Regulations and Guidance Booklet for Special Arrangements and Special Consideration.

In such cases, advice should be sought from the OCR Special Requirements team (telephone 01223 552505) as early as possible during the course.

A Certificate of Achievement (COA) specification is also available and may be more suitable for some candidates.

12 Support and In-service Training for Teachers

To support teachers using this specification, OCR will make the following materials and services available:

- a full programme of In-Service training meetings arranged by the Training and Customer Support Division (telephone 01223 552950);
- specimen question papers and mark schemes, available from the Publications department (telephone 0870 8706622; fax 0870 8706621);
- past question papers and mark schemes, available from the Publications department (telephone 0870 8706622; fax 0870 8706621);
- written advice on coursework proposals;
- a report on the examination, compiled by senior examining personnel after each examination session;
- individual feedback to each Centre on the moderation of internally assessed work.