OCR GCSE IN MANUFACTURING (DOUBLE AWARD) (1496)

Foreword

This pack contains OCR's GCSE in Manufacturing (Double Award) Specification for teaching from September 2002.

First certification will be available in June 2004 and every January and June thereafter.

This specification is approved by QCA, ACCAC and CCEA as a qualification covering Levels 1 and 2 of the National Qualifications Framework.

Qualification Accreditation Number 100/1973/X

Key Features

- Fulfils NC PoS requirements at KS4 for Design and Technology for England.
- A clear progression route to the OCR VCE in Engineering and Manufacturing specifications.
- Specifications written in candidate-friendly language.
- Content similar to that of the OCR Part One GNVQs in Manufacturing.
- Guidance on the delivery and assessment within the specifications.
- Opportunities to co-teach across all GCSE Design and Technology specifications.
- Coursework can be linked to Key Skills.

Contents

Specimen Assessment Materials are included after this specification.

Specification Summary

SCHEME OF ASSESSMENT

Candidates will study the following **three** mandatory units.

Unit	Title	Type of Assessment	Entry Code	Weighting
1	Designing products for manufacture	Portfolio	4878	33.33%
2	Manufactured products	Portfolio	4879	33.33%
3	Application of technology	External	4880	33.33%

TIERS

The scheme of assessment consists of one tier covering the whole of the ability range grades A*A* to GG. Candidates achieving less than the minimum mark for grade GG will be unclassified.

INTERNAL ASSESSMENT

All candidates take Units 1 **and** 2.

EXTERNAL ASSESSMENT

All candidates take Unit 3. This unit is assessed through an externally set paper.

The paper comprises structured questions and will be one and a half hours in length. Candidates attempt **all** questions.

AVAILABILITY

External assessment is available in June 2004 and every January and June from 2005.

Portfolio moderation is available in June 2004 and every January and June from 2005. Centres wishing to receive earlier feedback or advice on coursework may arrange with OCR to contact a Portfolio Consultant.

First certification will be available in June 2004 and every January and June thereafter.

1 Introduction

1.1 RATIONALE

This specification leads to a GCSE in Manufacturing (Double Award) which covers both Levels 1 and 2 (Foundation and Intermediate Levels) of the National Framework of Qualifications and has been designed to raise attainment at these levels. Candidates study **three** units which provide a broad introduction to a wide range of vocational issues.

The specification builds upon the broad educational framework set out in the criteria for GCSEs in vocational subjects from the Qualifications and Curriculum Authority. GCSEs in vocational subjects are broad based vocational qualifications designed to widen participation in vocationally-related learning pre-16 and to encourage post-16 candidates to try a vocationally-related course where maybe another programme has previously not proved appropriate for them.

GCSEs in vocational subjects have been designed to contribute to the quality and coherence of national provision. They have been developed following widespread consultation by QCA in the autumn of 2000 and are based on Part One GNVQs which received positive Ofsted reports. GCSEs in vocational subjects have a clear place in the Government's vision for secondary education for the next ten years.

The GCSE in Manufacturing (Double Award) has been designed to form a qualification which provides the technical knowledge, skills and understanding associated with the subject at these levels so as to equip candidates with some of the skills they will need in the workplace or in further education or training. It allows candidates to experience vocationally-related learning so as to enable them to decide if it is suitable for them.

A GCSE in Manufacturing (Double Award) is an ideal qualification for those candidates who want a broad background in Manufacturing and the course of study prescribed by this specification can reasonably be undertaken by candidates entering this vocational area for the first time. It is designed to enable candidates to make valid personal choices upon completion of the qualification and to progress to further education, training or employment. It provides a suitable basis for further study in this subject or for related courses which could include GNVQs, VCEs, GCEs, NVQs or Modern Apprenticeships. It is designed to be delivered in full-time or part-time education.

Examples of appropriate employment to which a GCSE in Manufacturing (Double Award) candidate might progress include:

- domestic goods manufacturing;
- the food industry;
- system design and manufacture;
- assembly and production line work;
- packaging and printing.

Key Skills are integral to the specification and opportunities to provide evidence for the separate Key Skills qualification are signposted.

The fundamental philosophy of this specification is that, for candidates to understand fully the world of manufacturing, they must be actively involved in the design, production and evaluation of products and the methods by which these products are manufactured. This can be achieved through careful structuring of the teaching of this course, applying various strategies, using links with local industry, work experience and other work based studies to enhance candidates' learning. Schemes such as Young Enterprise, Duke of Edinburgh and other initiatives can also be used to provide stimulating and rewarding contexts for study.

This specification prepares young people for the made world by exploring design and technology and how it relates directly to manufactured products that we all, as consumers, buy and use. It differs from Design and Technology GCSE in that it focuses more specifically on the manufacture and production of products for use by a third party, the consumer. The specification has been written with flexibility in mind. Candidates can work in one or more material areas including food, textiles, paper and card, ceramics and resistant materials. The units are weighted to encourage quality and depth of understanding.

The GCSE in Manufacturing (Double Award) has been designed to provide a range of teaching, learning and assessment styles to motivate candidates to achieve the best they can and to empower them to take charge of their own learning and development. Assessment is designed to give credit for what candidates can do as well as what they know. It is based both on portfolio evidence from assignments, set and assessed by the Centre and moderated by OCR, and an external assessment, which is set and marked by OCR.

This specification is supported by users as well as a range of professional institutes and Further and Higher Education Institutions including E-business NTO, the national training organisation for this vocational area.

'*We are looking forward to moving from a variety of GCSEs and GNVQs into a single well balanced subject, giving all pupils the same starting point and opportunities' – JD (Head of D&T).*

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 Manufacturing (Double Award).

1.3 LEVEL OF QUALIFICATION

This qualification is approved by QCA at Levels 1 and 2 of the National Qualifications Framework.

Candidates who gain grades GG to DD will have achieved an award at Level 1.
Candidates who gain grades CC to A*A* will have achieved an award at Level 2.

This qualification is of a standard which is broadly equivalent to two GCSEs at grades G to A*.

1.4 SPECIFICATION AIMS

Manufacturing covers a wide range of sectors including chemicals, food and drink, paper and textiles. The GCSE in Manufacturing (Double Award) specification will enable candidates to develop a broad knowledge and understanding of the manufacturing industry, its organisation, products and processes through investigation, research and practical application.

The qualification will prepare candidates for employment, including work-based training, progression to Level 3 qualifications and provide an insight into manufacturing for candidates pursuing other career pathways. The qualification will introduce the skills, knowledge and understanding needed by those considering a career in the manufacturing industry.

The qualification will build on candidates' previous experience in a number of National Curriculum subjects at Key Stages 1,2 and 3 and will satisfy the requirements of the programme of study at Key Stage 4 for Design and Technology for England.

1.5 ASSESSMENT OBJECTIVES

Candidates for this qualification will be expected to demonstrate their ability to:

AO1 recall and apply their knowledge, skills and understanding specified in the subject content in a range of vocational situations;

AO2 plan and carry out investigations and tasks, using a range of tools, equipment, material, ingredients, components and processes, in which they analyse vocational issues and problems; and gather, record and analyse relevant information, data and other forms of evidence;

AO3 evaluate evidence, make reasoned judgements and present conclusions accurately and appropriately.

The weightings for the assessment objectives over the whole qualification are:

AO1	43%
AO2	32%
AO3	25%

The weightings for the assessment objectives per unit are:

	Unit 1	**Unit 2**	**Unit 3**
AO1	30%	30%	70%
AO2	40%	40%	15%
AO3	30%	30%	15%
	100%	100%	100%

1.6 RECOMMENDED PRIOR LEARNING

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

Prior learning, skills and aptitudes particularly relevant include:

- basic craft skills;
- some aptitude for ICT;
- basic drawing skills
- some motivation to work independently.

There is however no prior knowledge required for this specification.

1.7 PROGRESSION

1.7.1 Progression into Employment

This specification is designed to enable candidates to enter employment at operative or technician level within a wide range of manufacturing environments. Such candidates would normally enter employment through a work-related training programme.

The manufacturing sector is an important area of employment and the well developed personal skills (e.g. initiative, teamwork, problem-solving) combined with work-related knowledge gained within a GCSE in Manufacturing (Double Award) means that candidates are particularly suitable for recruitment in a range of employment categories, e.g. general manufacturing, product design, customer relations, project management.

1.7.2 Progression to Further Qualifications

Candidates who achieve this qualification at Level 1 may wish to continue to courses such as a GNVQ award or NVQ Performing Manufacturing Operations at Level 1, or, if suitably qualified in other areas, could progress to courses such as Intermediate GNVQ in Manufacturing or NVQ Performing Manufacturing Operations at Level 2.

Candidates who achieve this qualification at Level 2 may wish to continue to courses such as an Intermediate GNVQ award or NVQ Performing Manufacturing Operations at Level 2, or, if suitably qualified in other areas, could progress to courses leading to the VCE in Manufacturing or GCE in Design and Technology or NVQ Performing Manufacturing Operations at Level 3.

A GCSE (Double Award) qualification may also be considered as equivalent to two GCSEs at grades A* to G for the purposes of admission to other level courses within the National Qualifications Framework, including GCSEs in other vocational areas.

1.8 RELATED QUALIFICATIONS

1.8.1 GCSEs/GNVQs

The units of this qualification have a significant overlap of content with the OCR GCSE Design and Technology, although it is expected that the teaching and assessment methods will be significantly different. The units also have a significant overlap of content with the OCR GNVQ in Manufacturing and the OCR GCSE in Engineering (Double Award).

The content of the three units of the GCSE in Manufacturing (Double Award) is very similar to that of Units 1, 2 and 3 of the six-unit GNVQs in Manufacturing.

1.8.2 Relationship to NVQs

This specification broadly introduces the candidate to skills relevant to a range of work based NVQs in Performing Manufacturing Operations, though the assessment methods are not designed to guarantee occupational competence. However, this qualification will support candidates working towards National Occupational Standards, detailed guidance for which will be issued by QCA in early 2002.

Unit 2: *Manufactured products*, in particular, broadly contributes knowledge, understanding and skills for NVQ Performing Manufacturing Operations and work based learning Levels 1, 2 and 3.

1.8.3 Exclusions

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

Owing to overlap of content, there are restrictions on entering candidates for the following qualifications: GNVQ Manufacturing (Foundation or Intermediate); GNVQ Engineering (Foundation or Intermediate); GCSE Engineering. Such restrictions, if not prevented at the point of entry, will be picked up both when funding is calculated and when results leading to points towards performance tables are aggregated, as all of the above qualifications will have the same classification code and so be discounted for funding and performance table purposes.

1.9 SPIRITUAL, MORAL, ETHICAL, SOCIAL AND CULTURAL ISSUES

It is hoped that candidates studying this subject will gain an awareness of the effect of manufacturing and technological changes and how this influences communities, populations and individuals.

It is expected that this specification will be presented in ways which give scope for candidates to investigate how trends in manufacturing have had an impact on employment and related changes in the work place.

Legal issues are addressed in each unit, where appropriate.

Candidates will also work in teams and evaluate the relative strengths and weaknesses of members of these teams. This will enable them to develop an understanding of the importance of individuals in teams and the variety of roles.

Signposting

The purpose of the table on the following page is to signpost further possible opportunities for assessing Spiritual, Moral, Ethical, Social and Cultural (SMESC) related issues.

Key:

Sp Spiritual **M** Moral **E** Ethical **So** Social **C** Cultural

Unit	Content	Sp	M	E	So	C
1	• How the manufacturing industry brings a product to the market place: **So C** issues will impact on design briefs of clients and how this is interpreted. • **M** and **E** will play a part in the interpretation of the design brief – professional **M** and **E** obligation to fulfil the brief (e.g. cheapest possible versus best option). • Discussing ideas with others: **Sp So C** to be responsive and aware of cultural and spiritual diversities, and how this may impact on communication and expectations.	*	*	*	*	*
2	• Schedule for manufacture: **Sp So C** (e.g. taking into account religious holiday and festivities affecting days available for work). • Quality control and health, safety and hygiene will introduce **M** and **E** considerations in terms of what is 'right', 'best' and/or fit for purpose, and in the use of certain products and processes. • Effective teams and the allocation of roles and working with different groups of people: **Sp So C**. **M** and **E** may also be included here in terms of respecting differing **Sp So C** orientations.	*	*	*	*	*
3	• Implications of technology introduce **M** and **E** (e.g. increased technology such as robotics may lead to job losses). This will have a **So** impact which may differ across **Sp** and **C** groups. • The use of certain materials or processes may be by particular **Sp** or **C** groups.	*	*	*	*	*

1.10 CITIZENSHIP

Through the study of this subject it is hoped that candidates will develop further their social and moral responsibility. They will also be given the opportunity to develop their self-confidence and socially and morally responsible behaviour, both in and beyond the classroom.

The nature of this subject will enable candidates to develop a greater understanding of the role of manufacturing and employment in their community.

They will also have the opportunity to look at the influence politics has on the field of manufacturing, locally, regionally and nationally, and how political influences can help in a global market.

Signposting

The purpose of the following table is to signpost further possible opportunities for delivering Citizenship related issues.

Unit	Content
1	• Discussing ideas with others: to be responsive and aware of cultural and spiritual diversities, and how this may impact on communication and expectations (possible connections).
2	• Quality control and health, safety and hygiene may introduce citizenship issues in terms of *right conduct*. • Effective teams and the allocation of roles and working with different groups of people: respecting differing orientations.
3	• Implications of technology (e.g. how computer literacy has affected rights etc.).

1.11 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.

In Unit 1: *Designing products for manufacture* and Unit 2: *Manufactured products*, candidates are expected to consider environmental issues such as:

- the moral and legal responsibilities of designers and manufacturers to the end user and society in general;
- the importance of product labelling and product descriptions;
- where appropriate, any legislation, e.g. Health and Safety at Work, British Standards, food labelling;
- the difference between scrap and waste and how scrap and waste can be disposed of;
- recyclability and effects on the environment of both manufacturing processes and end products;
- the life cycle of a product.

Signposting

The purpose of the following table is to signpost further possible opportunities for delivering environment related issues.

Unit	Content
1	• Design briefs will possibly have to conform to meet environmental concerns. • Material details and constraints.
2	• Quality control and health, safety and hygiene may introduce environmental issues in terms of what is 'right', 'best' and/or fit for purpose and in the use of certain products and processes.
3	• Implications of technology. • The global environment and sustainability. • The use of certain materials may involve environmental concerns.

1.12 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.

Whilst at this level, local and national issues will predominate, teachers are expected to take appropriate opportunities to consider issues in the European context.

The nature of manufacturing can be strongly influenced through the impact of companies utilizing skills in manufacturing in different European countries. Because of this, it is expected that candidates will investigate the role of the UK and its influence in manufacturing terms within the European Union.

Signposting

The purpose of the following table is to signpost further possible opportunities for delivering European related issues.

Unit	Content
1	• Design briefs will have to conform to European standards. • Material details and constraints: European and associated regulations.
2	• Quality control and health, safety and hygiene may introduce European/legislation issues in terms of what is 'right', 'best' and/or fit for purpose and in the use of certain products and processes.
3	• Implications of technology. • The use of certain materials may involve European concerns.

1.13 HEALTH AND SAFETY

Candidates are introduced to health and safety issues in the context of this sector and should be made aware of the significance of safe working practices.

Candidates should be made aware, at all times, of the need for working in a safe environment.

Candidates should develop an understanding of wider health and safety issues, such as pollution, and other environmental dangers to which manufacturing can contribute.

Candidates need to be aware of any legislation pertaining to Health and Safety which will have an impact upon either their working practices or the product on which they are working.

1.14 STATUS IN WALES AND NORTHERN IRELAND

This specification has been approved by ACCAC for use by Centres in Wales and by CCEA for use by Centres in Northern Ireland.

Candidates in Wales or 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 will provide specifications, assessments and supporting documentation in English. Further information concerning the provision of assessment materials in Welsh and Irish may be obtained from the Information Bureau at OCR (telephone 01223 553998)[1].

[1] The OCR Information Bureau is open to take your calls between 8.00am and 5.30pm. Please note that as part of our quality assurance programme your call may be recorded or monitored for training purposes.

2 Scheme of Assessment

2.1 NATURE OF ASSESSMENT

The assessment will be conducted in accordance with the GCSE, GCE, VCE and GNVQ Code of Practice. Two units will be assessed internally, through a teacher-assessed portfolio (see Section 2.3) and one unit will be assessed externally with the assessment set and marked by OCR (see Section 2.4). All internal assessment will be moderated by OCR.

2.2 UNITS

The content of each unit, together with detailed assessment evidence requirements, is described in Sections 5 to 8.

Candidates will study the following **three** mandatory units.

Unit	Title	Type of Assessment	Entry Code	Weighting
1	Designing products for manufacture	Portfolio	4878	33.33%
2	Manufactured products	Portfolio	4879	33.33%
3	Application of technology	External	4880	33.33%

External assessment is available in June 2004 and every January and June from 2005.
Portfolio moderation is available in June 2004 and every January and June from 2005.
First certification will be available in June 2004 and every January and June thereafter.

2.3 PORTFOLIO ASSESSMENT

2.3.1 Supervision and Authentication of Portfolios

OCR expects teachers to supervise and guide candidates who are producing portfolios. The degree of teacher guidance in candidates' work will vary according to the kind of work being undertaken. However, it should be remembered that candidates are required to reach their own judgements and conclusions.

When supervising candidates, teachers are expected to:

- offer candidates advice about how best to approach their tasks;
- 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 specified marking criteria and procedures.

Work on portfolios may be undertaken outside the Centre and in the course of normal curriculum time. As with all internally assessed work, the teacher must be satisfied that the work submitted for assessment is the candidate's own work. This does not prevent groups of candidates working together in the initial stages, but it is important to ensure that the individual work of a candidate is clearly identified separately from that of any group in which they work.

Throughout the course, the teacher should encourage the candidate to focus on achieving the criteria listed in the *Assessment Evidence Grids*. Teachers may set internal deadlines for candidates submitting work to them. Teachers may comment on a candidate's unit portfolio and return it for redrafting without limit until the deadline for the submission of marks to OCR. Internal Assessors must record details of any assistance given and this must be taken into account when assessing candidates' work. Once the mark for the unit portfolio has been submitted to OCR, no further work may take place.

2.3.2 Production and Presentation of Portfolios

Candidates must observe the following when producing portfolios:

- 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 code and title;
  unit code.

- All work submitted for moderation should be removed from cardboard files, ring binders and plastic wallets. Work must be held together by using treasury tags or an appropriate alternative (not paper clips).

2.3.3 Administering Portfolio Assessment

OCR will conduct all administration of the GCSEs in vocational subjects through the Examination Officer at the Centre. Teachers are strongly advised to liaise with their Examination Officer to ensure that they are aware of key dates in the administrative cycle.

Assessment Record materials, including full details of administrative arrangements for portfolio assessment, will be forwarded to Examination Officers in Centres in Autumn 2002, following receipt of provisional entries. At the same time the materials will be made available within the Teacher's Guide and on the OCR website (www.ocr.org.uk). The materials will include master copies of mandatory forms on which to record assessments and will also include optional recording materials for the convenience of Centres. Forms may be photocopied and used as required.

The Assessment Evidence Grids

Centres are required to carry out internal assessment of portfolios using the *Assessment Evidence Grids* in accordance with OCR procedures. The process of using these grids is described in Section 2.3.4. Candidates' marks are recorded on the Unit Recording Sheets (URS). One URS should be completed for each candidate's unit portfolio. This URS should be attached to the front of the candidate's portfolio for the unit when sent to the Moderator.

When candidates are given their assignments, they should also be issued with a reference copy of the appropriate *Assessment Evidence Grid*.

Candidates' portfolios should be clearly annotated to demonstrate where, and to what level, criteria have been achieved. This will help in the moderation process. If teachers do this well it will be very much in the interests of their candidates. On completion of a unit, the teacher must complete the URS and award a mark out of 50 for the unit. Details of this process are described in Section 2.3.4.

Internal Standardisation

It is important that all internal assessors, working in the same subject area, work to common standards. Centres are required to ensure that internal standardisation of marks across assessors and teaching groups takes place using an appropriate procedure.

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

Submission of Marks to OCR

The involvement of OCR begins on receipt of entries for a portfolio unit from a Centre's Examinations Officer. Entries for units to be included in any assessment session must be made by the published entry date from OCR. Late entries attract a substantial penalty fee.

By an agreed internal deadline the teacher submits the marks for the unit to the Examinations Officer. Marks will need to be available by the portfolio mark submission dates published by OCR and internal deadlines will need to reflect this. OCR will supply Centres with *MS1 Internal Assessment Mark Sheets* to record the marks and instructions for completion. It is essential that Centres send the top copy of these completed forms to OCR, the second copy to the Moderator and keep the third copy for their own records.

Moderation

Moderation will take place by post in January and June. Shortly after receiving the marks, the Moderator will contact the Centre and inform them of the sample of candidates' work that will be required, as outlined in Section 2.3.5.

2.3.4 Applying the Assessment Criteria

Sources of Guidance

The starting point in assessing portfolios is the *Assessment Evidence Grid* within each unit. These contain levels of criteria for the skills, knowledge and understanding that the candidate is required to demonstrate. The *Guidance for Teachers* within the unit expands on these criteria and clarifies the level of achievement the assessor should be looking for when awarding marks.

Before the start of the course OCR will produce a *Handbook for Teachers*. At Inset sessions in the autumn term OCR will provide examples of candidates' work which help to exemplify standards at grades AA, CC and FF that have been agreed with QCA and the other Awarding Bodies.

In the Autumn and Spring terms OCR will hold training meetings on portfolio assessment led by senior GCSE Moderators. Details of these are in the OCR INSET booklets which are sent to Centres in the Summer term or they may be obtained from the Training and Customer Support Division on 01223 552950. They are also published on the OCR website (www.ocr.org.uk).

OCR also operates a network of Portfolio Consultants. Centres can obtain advice on assessment of portfolios from an OCR Portfolio Consultant. These are both subject specialists and senior Moderators. Details of these may be obtained from the OCR Subject Officer.

Determining a Candidate's Mark

Each unit portfolio should be marked by the teacher according to the criteria in the *Assessment Evidence Grid*. Each row in the grid comprises a strand showing the development of a given criterion and corresponds to a point (a, b, c etc.) in the banner.

Each column describes the work undertaken by a candidate working within a range of grades. The criterion in the first column describes typical attainment of a candidate working within the range of grades GG to EE. The second column describes the work of a typical candidate working at grades DD, CC and the lower half of grade BB whilst the third column describes the work of a typical candidate working at the upper half of grade BB, grades AA and A*A*.

The maximum mark for that strand is shown in the right hand column.

Teachers use their professional judgement and circle the mark that *best fits* the work of the candidate and also record it on the URS in the column headed *Mark*.

Centres should use the full range of marks available to them; Centres must award *full* marks in any band for work which fully meets the criteria. This is work which is 'the best one could expect from candidates working at GCSE (Double Award) level'.

Only one mark per strand/row will be entered. The final mark for the candidate is out of a total of 50 and is found by totalling the marks for each strand.

Centres may find it helpful to use the assessment criteria holistically when initially assessing candidates' work. The outcome can then be compared with the final grade awarded through the procedure outlined above. If these differ, an explanation should be sought and the differences resolved.

2.3.5 Portfolio Moderation

After the unit portfolio is internally marked by the teacher and marking has been internally standardised, marks are submitted to OCR by a specified date, published in the Key Dates poster, 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.

It is essential that the rank order of marks supplied to a Moderator is correct. If Centre assessment is inconsistent, work will be returned to the Centre for re-assessment.

The sample of work which is presented to the Moderator for moderation must show how the marks have been awarded in relation to the marking criteria defined in the unit.

Moderation for all units will be available in the January and June sessions.

Principles of Moderation

The following principles, agreed by the Awarding Bodies and QCA, indicate, in broad terms, how portfolio units will be moderated. OCR has detailed procedures that Moderators will follow to implement the moderation process.

Centres submit unit marks to OCR and to the Moderator by the published OCR submission dates.

The Moderator will select, from each unit, a sample of candidates' portfolios that covers a range of grades.

If the work seen overall has been assessed accurately and consistently to agreed national standards, within agreed tolerances, all unit marks submitted by the Centre are accepted with no adjustments.

Adjustments, where required, will be carried out by OCR using its normal procedure. Centres are not required to amend marks except if administrative issues, errors or order of merit problems are discovered.

Whilst Moderators may seek clarification from a Centre, they cannot negotiate portfolio marks in any way. OCR will inform Centres of the outcome of the moderation process at the time of publication of results. This will include a written report on any significant issues that arose during this process.

2.4 EXTERNAL ASSESSMENT

2.4.1 Tiering

The scheme of assessment consists of one tier covering the whole of the ability range grades A*A* to GG. Candidates achieving less than the minimum mark for grade GG will be unclassified.

2.4.2 Nature of External Assessment

OCR has designed external assessments which allow candidates to apply the knowledge and understanding they have gained from teacher-designed activities and assignments based on the *What you need to learn* section of the units.

It should be emphasised that unit delivery should not be focused on preparing candidates solely for the external assessment with the result that wider learning opportunities are missed. The external assessment forms only a small proportion of the learning within the unit but the grade achieved through it is based on the GNVQ approach to learning which involves practical work, assignments and independent research.

Specimen assessment material is included with this specification.

2.4.3 Re-sits

Candidates will be permitted to re-sit each assessment unit once only with better mark counting towards the final grade. Candidates may, however, retake the whole qualification more than once. For the purposes of the re-sit rule, it is the results of, not the entry for, a unit that counts.

The shelf life of assessment unit results is limited only by the shelf life of the qualification.

2.5 ADMINISTRATIVE ARRANGEMENTS

All administrative arrangements regarding entries, submission of marks, moderation, receipt of results documentation etc. are to be made through Examinations Officers.

Please note that it is very important for Examinations Officers to register provisional entries for Centres since this is the mechanism which triggers the issue of assessment recording materials and pre-release materials etc. to Centres.

2.5.1 Unit and Certificate Entries

Note that entry for units will *not* generate a final certificate – a separate certification entry for code 1496 must be made. This will usually be along with the final unit entries.

A candidate who has completed all the units required for a qualification may enter for certification at a later examination series. For example, a candidate who has completed all the required units but who has not entered for certification may do so in the *same* examination series within a specified period after the publication of results.

First certification will be available in June 2004 and every January and June thereafter.

2.5.2 Unit Availability

External assessment is available in June 2004 and every January and June from 2005.
Portfolio moderation is available in June 2004 and every January and June from 2005.

2.5.3 Moderation Arrangements

Portfolio moderation is offered in January and June. Centres wishing to receive earlier feedback or advice on coursework may arrange with OCR to contact a Portfolio Consultant.

Centres submit unit marks to OCR and to the Moderator by the published OCR submission dates.

2.5.4 Issue of Results

Individual assessment unit Statement of Results will be issued for all units (both portfolio units and external units) and will include, for each unit, the unit title, the unit UMS mark, information enabling UMS marks to be equated to GCSE (Double Award) grades and the date the unit was taken.

Candidates must be entered for certification code 1496 to claim their overall grade.

Note that entry for units will *not* generate a final certificate – a separate certification entry must be made at the appropriate time.

Certificates will include an explanatory note on the nature of double awards.

2.5.5 Fresh Start

To cater for candidates who need to restart a qualification, the Centre may request that all previous unit results relating to that qualification should be deleted. For example, a candidate may wish to make a *fresh start* after a period spent out of education. In such cases, OCR will use its discretion to decide whether such a request can be granted, given the time-scales involved and the need to uphold the integrity of the re-sit rules outlined above. Such requests will not normally be granted for whole cohorts of candidates.

2.6 GRADE DESCRIPTIONS

The following grade descriptions indicate the level of attainment characteristic of the given grade for this GCSE (Double Award). They give a general indication of the required learning outcomes at each specified grade. The descriptions should be interpreted in relation to the content outlined in the specification; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the assessment may be balanced by better performances in others.

Grade FF Candidates are able to recall and apply basic knowledge, skills and understanding to manufacturing problems and tasks. Candidates will make use of a limited range of sources of information to analyse manufacturing problems and will clarify their ideas through discussion, drawing, modelling and preparing samples. With some support and guidance, candidates will plan and carry out investigations and will work with a range of tools, materials, equipment, ingredients, components and processes with some precision in a safe and appropriate manner. Candidates will check their work as it develops and modify their approach in the light of progress. They will gather, record and analyse information from a limited range of evidence to test and evaluate their solutions to manufacturing problems. They will present conclusions based on a limited evaluation of the evidence.

Grade CC Candidates are able to recall and apply knowledge, skills and understanding to a range of manufacturing problems and tasks. Candidates will make use of a wide range of appropriate sources of information to analyse manufacturing problems and develop ideas. They will use a range of strategies to develop, clarify and communicate ideas, using appropriate media. With limited guidance, candidates will plan and carry out investigations, producing plans that make effective use of time and resources and will work with a range of tools, materials, equipment, ingredients, components and processes. They will organise their work so that they can carry out processes accurately and consistently, and use tools, equipment, materials, ingredients and components with precision in a safe and appropriate manner. They will adapt their methods of manufacture to changing circumstances, providing a sound explanation for any changes from the plan. Candidates will gather, record and analyse information from a range of sources, selecting appropriate techniques to test and evaluate solutions. They will present reasoned conclusions, based on their evaluation of the evidence.

Grade AA Candidates will recall and apply knowledge, skills and understanding to range of complex manufacturing problems and tasks. Candidates will be discriminating in their selection and use of a wide range of information sources to analyse manufacturing problems and develop ideas. They will identify conflicting demands on the design, manufacture and use of products. They will use a wide range of strategies to develop, clarify and communicate appropriate ideas and solutions using appropriate media. Candidates will independently plan and carry out investigations, making effective use of time and resources. They will demonstrate a sound understanding of materials, processes and components and will work with a range of tools, equipment, materials, ingredients and components to a high degree of precision in a safe and appropriate manner. They will organise their work so that they can carry out processes accurately and consistently and will review and adapt their methods of manufacture to changing circumstances, providing a well-reasoned explanation for any changes to the plan. They will gather, record and analyse information from a wide range of appropriate sources and will identify and apply a broad range of criteria for evaluating and testing their solutions. They will present carefully reasoned and appropriate conclusions, based on a systematic evaluation of the evidence.

2.7 AWARDING AND REPORTING

A new section of the Code of Practice, for GCSE (Double Award) qualifications, is to be introduced in September 2002. The qualifications will comply with the grading, awarding and certification requirements of this section of the Code of Practice.

A uniform mark scale (UMS) will be used to aggregate individual assessment units to generate qualification grades.

2.7.1 Unit Grades

Teachers assess each portfolio unit and award a raw score on a scale of 0-50. The evidence required to support the award of marks is given in the *Assessment Evidence* section of each unit. The OCR awarding committee will consider portfolios and will determine the grade thresholds for each unit.

The following table indicates the notional thresholds for the unit, but these are subject to adjustment by the awarding committee.

Grade	**A*A***	**AA**	**BB**	**CC**	**DD**	**EE**	**FF**	**GG**
Mark	45	40	35	30	25	20	15	10

The externally assessed unit will be marked by OCR. The maximum raw score will be stated on the front cover of the question paper.

2.7.2 Uniform Marks

Once the raw score for each unit has been established, it will be converted by OCR and reported to candidates as a Uniform Mark out of 100.

Uniform marks correspond to *unit* grades as follows:

	A*A*	**AA**	**BB**	**CC**	**DD**	**EE**	**FF**	**GG**
UMS (max 100)	90	80	70	60	50	40	30	20

Candidates who fail to achieve the standard for a grade GG will be awarded a Uniform Mark in the range 0-19 and will be recorded as UU (unclassified).

2.7.3 Overall Grade

The uniform marks awarded for each unit will be aggregated and compared to pre-set boundaries. Results for the qualification will be awarded on a scale of A*A* to GG and will be recorded twice on the certificate as such.

Uniform marks correspond to *overall* grades as follows:

	A*A*	**AA**	**BB**	**CC**	**DD**	**EE**	**FF**	**GG**
UMS (max 300)	270	240	210	180	150	120	90	60

2.8 SPECIAL ARRANGEMENTS

Candidates with special requirements must cover the assessment objectives. There may be more suitable ways of doing this than those used by the Centre with other candidates. Any Centre wishing to start candidates with special requirements on the course who might not be able to meet the requirements of the assessment must consult the Special Requirements Unit before doing so (telephone 01223 552505).

2.9 RESULTS ENQUIRIES AND APPEALS

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

For procedures relating to enquiries on results and appeals, Centres should consult the Handbook for Centres and the document *Enquiries about Results and Appeals - Information and Guidance for Centres* produced by the Joint Council. Further copies of the most recent edition of this paper can be obtained from OCR.

3 Further Information and 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 its Training and Customer Support Division (telephone 01223 552950);
- a dedicated subject-specific telephone number (01223 552732);
- a website that will include materials to assist with delivery (www.ocr.org.uk);
- teacher support material;
- exemplar candidate work;
- candidate guides;
- specimen assessments;
- past external examinations;
- a report on the examination, compiled by senior examining personnel after each examination session;
- individual feedback to each Centre on the moderation of portfolios;
- a portfolio consultancy service.

A Publications Catalogue may be obtained from OCR's publications department:

- tel. 0870 870 6622
- fax 0870 870 6621
- e-mail: publications@ocr.org.uk

The OCR Information Bureau:

- tel. 01223 553998
- e-mail: helpdesk@ocr.org.uk

The OCR website address is www.ocr.org.uk

The website contains copies of the specification, example assessments, support materials and current information of relevance to Centres.

4 Key Skills Guidance

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, learning and assessment of the vocational content, as well as that of the Key Skills. Opportunities for developing the Key Skills of *Communication, Application of Number, Information Technology, Working with Others, Problem Solving* and *Improving Own Learning and Performance* are indicated for each unit.

Key Skills and vocational achievement are interdependent, especially at Level 1. This guidance has been developed to show how vocational and Key Skills achievement can be successfully combined.

The guidance has been split into two sections: *Keys to Attainment* and *Signposts*. The two sections should be used in conjunction with, and are intended to complement, each other.

Keys to Attainment show where the units contain clear opportunities for generating Key Skills portfolio evidence. A *Key to Attainment* does not negate the need for candidates to develop and practise the key skill during teaching and learning.

Signposts ∫ show where the units contain opportunities for developing the Key Skill, and possibly for generating portfolio evidence if teaching and learning is focused on that aim.

Aspects of Key Skills are distributed throughout the units, usually as *Signposts* but sometimes as *Keys to Attainment*. This may appear repetitive, but occurs because some Key Skills may be achieved in several different ways (multiple *Signposts*), but others are genuinely key to the achievement of the vocational aspect (*Keys to Attainment*). For example, IT1.1 - 'find, explore and develop information for **two** different purposes', will appear more than once in any GCSE (Double Award) because the Key Skill needs to be achieved in **two** different contexts. Another example of where a Key Skill may be split between units is C1.1 - 'take part in a *one-to-one* discussion and a *group* discussion...', because the **two** discussions can be completely independent of each other.

KEY SKILLS MAPPING

🔑 the unit contains clear opportunities for generating Key Skills portfolio evidence.
∫ the unit contains opportunities for developing the Key Skill, and possibly for generating portfolio evidence if teaching and learning is focused on that aim.
8 there are no obvious opportunities for the development or assessment of the Key Skill in the unit.

Key Skill (Level 2)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
C2.1a: Contribute to a discussion about a straightforward subject.	**1**	🔑	Discussing the design brief with the client to clarify their requirements, or with other members of the design team to formulate a design specification, generate ideas etc.
	2	∫	Discussing the production plan with other members of the production team to develop the production schedule. Reviewing plan and schedule during production e.g. discussing quality control findings.
	3	∫	Identifying and discussing the impact of new technology, with the class or others e.g. someone with long experience of working in manufacturing. Considering advantages and disadvantages for e.g. the workforce and the environment etc.
C2.1b: Give a short talk about a straightforward subject, using an image.	**1**	🔑	Presenting a range of design solutions and ideas to the client to get their feedback, as part of the development process, explaining key features, production and materials constraints, and quality standards. Presenting the final design solution to the client, making use of drawings, models etc as necessary.
	2	∫	Presenting information to the production team, on e.g. health and safety, levels of materials, the quality of the finished product, any modifications to the schedule or plan felt to be necessary etc. Using appropriate visual aids.
	3	∫	Presenting results of the investigation of a manufactured product, using drawings and sketches, or of an investigation of a particular form of new technology such as polymers.
C2.2: Read and summarise information from **two** extended documents about a straightforward subject. **One** of the documents should include at least **one** image.	**1**	∫	Design briefs and design specifications, relevant regulations, data sheets, market research reports, manuals, textbooks etc. There must be evidence that information from such sources has been summarised in the candidate's written work.
	2	🔑	Production plans and schedules, product specifications, data sheets, manuals and guides for machinery, tools and equipment, information on manufacturing processes, health and safety regulations, quality manuals, textbooks, etc. There must be evidence that information from such sources has been summarised in the candidate's written work.
	3	∫	Product information: manuals, guides etc, promotional materials for companies using new technology, suppliers catalogues, textbooks, trade magazines etc. There must be evidence that information from such sources has been summarised in the candidate's written work.
C2.3: Write **two** different types of documents about straightforward subjects. **One** piece of writing should be an extended document and include at least **one** image.	**1**	🔑	Producing a product design specification and a design solution based on the design brief. The design solution will include information on production constraints etc, an explanation of how the brief was met, with drawings and models etc as appropriate. Design ideas in their development e.g. sketches, prototypes and the analysis of materials will also be supported by text. Producing a modified design proposal. Producing a risk assessment.
	2	∫	Producing a schedule for manufacture, based on a given production plan, with explanatory text. Also, explanations of use and suitability of processing and preparation methods for given materials, and of the use of tools, equipment etc. Recording quality and production control data and analysing findings. Reporting on health and safety and hygiene issues and identifying points where checks should be made.
	3	∫	Reports on particular examples of new technology, with drawings. Product reviews or reports about products featuring new technology, identifying the sector in which they were manufactured, the main stages in their manufacture, the role of the new technology and an explanation of their operation, purpose etc.

Key Skill (Level 2)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
N2.1: Interpret information from **two** different sources, including material containing a graph.	**1**	∫	Interpreting numerical information on production details and constraints, the properties of materials, scales of production, costs etc. as part of developing design solutions.
	2	🔑	Interpreting technical information from a production plan, relating to components, ingredients, materials properties, quality and production control data, drawings etc.
	3	∫	Interpreting technical information on the properties of materials, on the structure and form of manufactured products etc.
N2.2a: Carry out calculations to do with amounts and sizes.	**1**	🔑	Calculating resources for manufacture: amounts of raw materials or ingredients, labour, costs etc., measuring quantities and materials, calculating product dimensions, tolerances etc.
	2	🔑	Calculating and maintaining levels of resources, identifying correct calibration of machinery etc, making any modifications necessary during production.
	3	🔑	Investigating the structure and composition of a manufactured product: dimensions, quantities manufactured etc.
N2.2b: Carry out calculations to do with scales and proportions.	**1**	🔑	Working with ingredients, scale models, etc., working out scales of production and cost implications of changing scale.
	2	🔑	Working with dimensions e.g. in relation to the size of components, quantities of ingredients etc.
	3	∫	Working with dimensions and producing scale drawings to explain how a product works.
N2.2c: Carry out calculations to do with handling statistics.	**1**	🔑	Working with quality control information, considering markets for the product, quantifying feedback during the development of design ideas etc.
	2	🔑	Working with quality control data and information on variance in production.
	3	🔑	Quantifying the different products made by the engineering and manufacturing sectors, and the impact of new technologies in terms of e.g. market share, range of products available, energy consumption etc.
N2.2d: Carry out calculations to do with using formulae.	**1**	∫	Considering any relevant scientific principles underpinning the functioning of the product.
	2	∫	Considering the scientific principles underpinning the use of tools, equipment and machinery in production.
	3	∫	Explaining the operation of a manufactured product in terms of its underlying scientific principles.
N2.3: Interpret the results of your calculations and present your findings. You must use at least **one** graph, **one** chart and **one** diagram.	**1**	🔑	Presenting the results of calculations of cost, quantity, product size, tolerances, etc in the final design solution, using a range of appropriate graphical methods and drawings.
	2	🔑	Presenting numerical information in the production schedule, and in modifying the production plan, on e.g. sequencing and timing, quantities, tolerances, critical control points, etc. based on own calculations and using appropriate graphical methods.
	3	∫	Presenting the results of investigations of a manufactured product, showing its properties, dimensions, how new technology has influenced the design etc.

Key Skill (Level 2)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
IT 2.1: Search for and select information for **two** different purposes.	**1**	∫	The internet, CD ROMS, databases etc are possible sources of technical data e.g. on materials constraints and production methods. Providing details of markets and existing product lines, information on production methods and sources of materials, ideas for styling and aesthetics, images which might be used in presentations etc.
	2	∫	The internet, CD ROMS, databases etc can provide information on the preparation and processing of materials and ingredients, on CAM, and the use of tools and equipment, on heath, safety and hygiene, quality systems etc.
	3	∫	The internet, CD ROMS, databases etc are good sources of product information and for information on the operation and impact of new technologies.
IT 2.2: Explore and develop information, and derive new information, for **two** different purposes.	**1**	∫	Developing design ideas through manipulating and finalising text and images, using spreadsheets, carrying out calculations, simulations, modelling etc. Developing information for use in presenting the final design solution.
	2		Using CAM, recording control data e.g. on materials or quality, and manipulating it to derive conclusions and inform production schedules, carrying out calculations, etc.
	3	∫	Carrying out calculations to use in describing and explaining products, drafting and finalising text to use in reports on new technology, importing images, using CAD drawings, etc.
IT 2.3: Present combined information for **two** different purposes. Your work must include at least **one** example of text, **one** example of images and **one** example of numbers.	**1**	∫	Presenting the final design solution using WP, drawings, imported images, graphical information on cost, materials, production, timescales etc. Presenting the product design specification, design ideas, production information etc to the client during the development of the final design.
	2	∫	Presenting the production schedule, using WP, the results of measurements and tests, drawings, graphical information on quality, quantity etc.
	3	∫	Reporting on new technology, using WP, imported text and images, etc. Drafting and finalising product report, using CAD, recording, manipulating and presenting numerical data etc.

Key Skill (Level 2)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
WO2.1: Plan straightforward work with others, identifying objectives and clarifying responsibilities, and confirm working arrangements.	**1**	∫	If the design brief is tackled by a team, it will be important that both group and individual objectives are allocated, and a plan for carrying out the work is agreed, with reference to timescales, resources, opportunities for feedback etc. Could fulfil the group-working requirement for this Key Skill.
	2	🔑	Team working. The production schedule should be supported by the clear allocation of production responsibilities for individuals and the group e.g. for testing samples for quality control, ensuring availability of materials etc. The schedule should show sequencing of tasks at all stages, quality control points etc.
	3	8	
WO2.2: Work co-operatively with others towards achieving identified objectives, organising tasks to meet your responsibilities.	**1**	∫	Allocating responsibilities to individuals which they must then pursue to achieve the group's objectives e.g. costing materials, researching the scale of production, identifying relevant regulations, testing materials etc. Showing co-operative and safe working, and seek advice as appropriate. If work in pairs or liase with client, could satisfy one-to-one working requirement for this Key Skill.
	2	🔑	Allocating production responsibilities to individuals which they must then pursue to achieve the group's objectives. Showing co-operative and safe working, and seek advice as appropriate. If work in pairs could satisfy one-to-one working requirement for this Key Skill.
	3	8	
WO2.3: Exchange information on progress and agree ways of improving work with others to help achieve objectives.	**1**	∫	If the group's work is planned to allow for progress checking, feedback and brainstorming e.g. on ideas for solving a technical problem in the design.
	2	∫	If the group's work is planned to allow for progress checking, feedback and brainstorming e.g. on ways of using particular processes, modifying the schedule etc.
	3	8	

Key Skill (Level 2)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
PS2.1: Identify a problem and come up with **two** options for solving it.	**1**		The design brief is the 'problem'. Identifying its key features: product design details, material details and constraints, researching information and data about materials, production etc, generating ideas and solutions, choosing ones which might work, and identifying constraints, taking advice where necessary. Also applies to decisions during the development of designs e.g. of about choosing a material.
	2		Analysing the production plan and identifying information for use in the schedule for manufacture, identifying several appropriate processing techniques, calibrations for machinery, sequencing etc. and choosing options which are most likely to be successful.
	3	8	
PS2.2: Plan and try out at least **one** option for solving the problem, obtaining support and making changes to your plan when needed.	**1**		Developing a design specification and design solutions based on research, showing how the product might be made and the constraints, testing solutions and making changes to the solution or design specification as necessary on the basis of testing and feedback.
	2		Planning the testing of materials and processes, and ideas for sequencing of manufacture, as part of developing the production schedule, and testing those ideas, logging results. Making changes and seeking advice as necessary while testing. Also, implementing the production plan and schedule, and making any changes which become necessary.
	3	8	
PS2.3: Check if the problem has been solved by applying given methods, describe results and explain your approach to problem solving.	**1**		Comparing the product or service with the design brief and product design specification, and drawing conclusions as to how well they were met. In the presentation of the design solution, explaining decisions at stage of the planning and production stage, and why they were necessary, evaluating the strengths and weaknesses of decisions, and any reflections on tackling such briefs again.
	2	∫	Comparing a sample product to the product specification. Applying any tests of size, function, quality etc specified in the production plan, and drawing conclusions as to how well it was met on the basis of those measurements and other feedback. Explaining decisions taken about materials, components and processes at each stage and why they were necessary, evaluating strengths and weaknesses in meeting the specification, with reflections on how production planning or scheduling might be improved.
	3	8	

Key Skill (Level 2)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
LP2.1: Help set short-term targets with an appropriate person and plan how these will be met.	**1**	∫	If the development of a design solution is supported by structured planning on a one-to-one basis with the candidate. Setting targets e.g. to choose the most appropriate ingredients, with deadlines and action points for achieving these e.g. to collect a range of sample ingredients etc.
	2	∫	If the development of manufacturing skills such as the use of different processes, the calibration of machinery is supported by structured planning on a one-to-one basis with the candidate. Setting targets e.g. to produce a sample of the product, with deadlines and action points for achieving these e.g. to practice using the machinery etc.
	3	8	
LP2.2: Take responsibility for some decisions about your learning, using your plan and support from others to help meet targets. Improve your performance by: • Studying a straightforward subject • Learning through a straightforward practical activity.	**1**	∫	If the candidate takes responsibility for successfully executing the plan agreed in LP2.1, and chooses different approaches to learning, e.g. reading market research results and making notes, finding and trying recipes etc. Taking advice where appropriate.
	2	∫	If the candidate takes responsibility for successfully executing the plan agreed in LP2.1, and chooses different approaches to learning, e.g. comparing their product to a commercially produced one, consulting manuals etc. Taking advice where appropriate.
	3	8	
LP2.3: Review progress with an appropriate person and provide evidence of your achievements, including how you have used learning from one task to meet the demands of a new task.	**1**	∫	Reviewing what has been learned and how they went about it, on a one-to-one basis with the candidate, e.g. in tutorials.
	2	∫	Reviewing what has been learned and how they went about it, on a one-to-one basis with the candidate, e.g. in tutorials.
	3	8	

Key Skill (Level 1)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
C1.1: Take part in a one-to-one discussion and a group discussion about *different* straightforward subjects.	**1**	🔑	Discussing the design brief with the client to clarify their requirements, or with the design team as a whole to formulate a design specification, generate ideas etc.
	2	∫	Discussing the production plan with other members of the production team to develop the production schedule, on an individual or group basis. Reviewing the plan and the schedule during production e.g. discussing quality control findings.
	3	∫	Identifying and discussing the impact of new technology, with the class or with individuals, e.g. the user of a product, a manufacturer etc. Talking about the advantages and disadvantages of new technology for e.g. the workforce, the environment etc.
C1.2: Read and obtain information from **two** different types of documents about straightforward subjects, including at least **one** image.	**1**	∫	Simple design briefs and design specifications, brochures, data sheets, extracts from market research reports, instructions booklets for machinery, textbooks etc.
	2	🔑	Production plans and schedules, product specifications, data sheets, manuals and guides for machinery, tools and equipment, information on manufacturing processes, health and safety regulations, quality manuals, textbooks, etc.
	3	∫	Product information: manuals, guides etc, promotional materials for companies using new technology, textbooks, trade magazines etc.
C1.3: Write **two** different types of documents about straightforward subjects. Include at least **one** image in **one** of the documents.	**1**	🔑	Producing a product design specification and a design solution based on the design brief. The design solution should include information on production constraints etc, an explanation of how the brief was met, with drawings and models etc as appropriate. Also design ideas in their development supported by text e.g. sketches, prototypes, a modified design proposal, a simple risk assessment.
	2	∫	Producing a schedule for manufacture, based on a given production plan, with text e.g. brief explanations of use and suitability of processing and preparation methods for given materials, and of the use of tools, equipment etc. Also. Records of quality and production control data, reports on health and safety and hygiene issues and identifying points where checks should be made.
	3	∫	Reports on particular examples of new technology, with drawings. Product reviews or reports about products featuring new technology, identifying the sector in which they were manufactured, the main stages in their manufacture, the role of the new technology and an explanation of their operation, purpose etc.

Key Skill (Level 1)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
N1.1: Interpret straightforward information from **two** different sources. At least **one** source should be a table, chart, diagram *or* line graph.	**1**	∫	Interpreting basic numerical information on production and constraints e.g. quantities, the properties of materials, scales of production, costs etc. as part of developing design solutions.
	2	🔑	Interpreting technical information from a production plan e.g. numbers of components, quantities of ingredients, materials' properties, simple quality and production control data, drawings etc.
	3	∫	Interpreting technical information on the properties of materials, on the dimensions of manufactured products etc.
N1.2a: Carry out straightforward calculations to do with amounts and sizes.	**1**	🔑	Calculating resources for manufacture: amounts of raw materials or ingredients, labour, costs etc, measuring quantities and materials, calculating product dimensions, tolerances etc.
	2	🔑	Calculating and maintaining levels of resources, identifying correct calibration of machinery etc.
	3	🔑	Investigating the dimensions and composition of a manufactured product, also details of how many are manufactured etc.
N1.2b: Carry out straightforward calculations to do with scales and proportion.	**1**	🔑	Working with ingredients, scale models, etc, working out scales of production and cost implications of changing scale.
	2	🔑	Working with dimensions e.g. in relation to the size of components, quantities of ingredients etc.
	3	∫	Working with dimensions and producing scale drawings to explain how a product works.
N1.2c: Carry out straightforward calculations to do with handling statistics.	**1**	🔑	Working with quality control information, considering markets for the product, producing simple statistics from feedback during the development of design ideas etc.
	2	🔑	Working with quality control data and information on variations during production.
	3	🔑	Quantifying the different products made by the engineering and manufacturing sectors, and the impact of new technologies in terms of e.g. market share, range of products available, energy consumption etc.
N1.3: Interpret the results of your calculations and present your findings. You must use **one** chart and **one** diagram.	**1**	🔑	Calculating cost, quantity, product size, tolerances, etc in the final design solution, using basic graphical methods.
	2	🔑	Calculating numerical information for use in the production schedule. Using results to develop the production plan, e.g. calculating resources required at different points, and presenting this information diagrammatically in the production plan.
	3	∫	Presenting the results of investigations of a manufactured product, e.g. using simple diagrams to show results of measurements etc.

Key Skill (Level 1)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
IT 1.1: Find, explore and develop information for **two** different purposes.	**1**	∫	Given sources from the internet, CD ROMS, databases and other non-IT sources may provide technical data e.g. on materials constraints and production methods. These may also be used to explore markets and existing product lines, and to obtain information on production methods and sources of materials etc. Also, to develop ideas e.g. for styling and aesthetics and provide images which might be used in presentations etc.
	2	∫	Given sources on the internet, CD ROMS, databases etc can be used in finding information e.g. on the preparation and processing of materials and ingredients, the use of tools and equipment, on heath, safety and hygiene, quality systems etc. Production information might also be recorded and developed using IT.
	3	∫	Given sources on the internet, CD ROMS or databases might be used to obtain product information and information on the operation and impact of new technologies. IT may also be used to record the results of investigations.
IT 1.2: Present information for **two** different purposes. Your work must include at least **one** example of text, **one** example of images and **one** example of numbers.	**1**	∫	Presenting the final design solution using WP, drawings, imported images, graphical information on cost, materials, production, timescales etc. Presenting the product design specification, design ideas, production information etc to the client during the development of the final design.
	2	∫	Presenting the production schedule using WP, also the results of measurements and tests, drawings, graphical information on quality, quantity etc.
	3	∫	Reporting on new technology using WP, imported text and images, etc. Drafting and finalising a product report, recording, manipulating and presenting numerical data etc.

Key Skill (Level 1)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
WO1.1: Confirm what needs to be done to achieve given objectives, including your responsibilities and working arrangements.	**1**	∫	If the design brief is tackled by a team, identifying the groups objectives and what needs to be done and confirming both group and individual responsibilities. Reference might be made to timescales, resources, opportunities for feedback etc. Could fulfil the group-working requirement for this Key Skill.
	2	🔑	Team working to make a product. Scheduling production will mean checking group aims and being clear on individual responsibilities e.g. for testing samples for quality control, ensuring availability of materials, timing activities etc. Also being clear on working methods.
	3	8	
WO1.2: Work with others towards achieving given objectives, carrying out tasks to meet your responsibilities.	**1**	∫	Individuals will be given their own responsibilities and working methods, and must show that they can carry tasks out safely and effectively to meet the design brief e.g. costing materials, researching the scale of production, identifying relevant regulations, testing materials etc. Asking for help and supporting other members of the design team. If working in pairs or liasing with client, could satisfy the one-to-one working requirement for this Key Skill.
	2	🔑	Individuals will be given their own responsibilities and instructed in the working methods they are expected to use. Carrying out individual production tasks e.g. quality control, safely and effectively, asking for help and supporting other members of the production team. If working in pairs or liasing with client, could satisfy the one-to-one working requirement for this Key Skill.
	3	8	
WO1.3: Identify progress and suggest ways of improving work with others to help achieve given objectives.	**1**	∫	If group working is planned in such a way as to allow discussion of progress, where good ways of tackling aspects of the design brief are identified, and problems and how they were dealt with identified, with a view to suggesting better ways of working together.
	2	∫	If group working is planned in such a way as to allow discussion of progress, identifying good ways of tackling production, as well as problems and how they were dealt with, with a view to suggesting better ways of working together.
	3	8	

Key Skill (Level 1)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
PS1.1: Confirm your understanding of the given problem with an appropriate person and identify **two** options for solving it.	**1**		The design brief is the 'problem'. With support from an appropriate person or people, identifying what the client wants to achieve, and picking out key features such as materials and constraints. Working with others to establish options for meeting the brief, including researching materials and production methods, generating ideas and solutions, etc. Identifying which options are likely to work best. Also applies to decisions during the development of designs e.g. about choosing a material.
	2		With support from an appropriate person or people, identifying ways to schedule manufacture from the production plan, e.g. identifying several appropriate processing techniques, calibrations for machinery, sequencing etc. and choosing options which are most likely to be successful, given basic constraints.
	3	8	
PS1.2: Plan and try out at least **one** option for solving the problem, using advice and support given by others.	**1**		Planning how the design specification and design solutions will be tackled, carrying out necessary research, showing how the product might be made and identifying basic constraints, trying out appropriate solutions, seeking advice as necessary.
	2		Planning the testing of materials and processes, and ideas for sequencing of manufacture, as part of developing the production schedule, and testing those ideas, logging results. Making changes and seeking advice as necessary. Also, implementing the production plan and schedule, and making any changes which become necessary.
	3	8	
PS1.3: Check if the problem has been solved by following given methods and describe the results including ways to improve your approach to problem solving.	**1**		Comparing the product or service with the design brief and product design specification, and saying how well they were met. In the presentation of the design solution, describing what went well and what didn't, and how problems were tackled. Also making suggestions for avoiding those problems.
	2	∫	Comparing a sample product to the product specification. Applying any tests of size, function, quality etc specified in the production plan, and describing results. Describing what went well in production and what didn't, and how problems were tackled. Also making suggestions for avoiding those problems.
	3	8	

Key Skill (Level 1)	Unit	Examples of opportunities for developing the Key Skill or for generating Key Skills portfolio evidence Note: these are illustrative only.	
LP1.1: Confirm understanding of your short-term targets and plan how these will be met, with the person setting them.	**1**	∫	If the group's work is planned to allow an appropriate person to set individual targets e.g. to learn about a production technique, to test a material, to choose the most appropriate ingredients etc. And also to identify: action points e.g. to collect a range of sample ingredients etc, deadlines, arrangements for reviewing progress, and who to ask for help.
	2	∫	If the development of manufacturing skills such as the use of different processes and the calibration of machinery is supported by structured target-setting with the candidate by an appropriate person. Targets might include learning about particular processes, etc. Also identifying: action points e.g. to practice using the machinery etc., deadlines, arrangements for reviewing progress, and who to ask for help.
	3	8	
LP1.2: Follow your plan, using support given by others to help meet targets. Improve your performance by: • Studying a straightforward subject • Learning through a straightforward practical activity.	**1**	∫	If the candidate follows the plan agreed in LP1.1, seeking support where necessary, and uses different approaches to learning, e.g. looking at examples of advertising and making notes, finding and trying recipes etc. Also acting on suggestions for improvements.
	2	∫	If the candidate follows the plan agreed in LP1.1, seeking support where necessary, and uses different approaches to learning, e.g. comparing their product to a commercially produced one, reading instruction manuals etc. Also acting on suggestions for improvements.
	3	8	
LP1.3: Review your progress and achievements in meeting targets, with an appropriate person.	**1**	∫	Reviewing what has been learned and how the candidate went about it, on a one-to-one basis e.g. in tutorials, with encouragement to identify good work and bad, and suggest improvements.
	2	∫	Reviewing what has been learned and how they went about it, on a one-to-one basis e.g. in tutorials, with encouragement to identify good work and bad, and suggest improvements.
	3	8	

5 Specification Units

Units will have some or all of the following sections:

About this unit

This includes a brief description for the candidate of the content, purpose and vocational relevance of the unit.
It states whether the unit is assessed externally or through portfolio evidence.

What you need to learn

This specifies the underpinning knowledge, skills and understanding candidates need to apply in order to meet the requirements of the portfolio evidence or external assessment.

Assessment evidence

This specifies the evidence candidates need to produce in order to meet the requirements of each portfolio unit. It is divided into the following parts:

- *You need to produce* – this banner heading sets the context for providing the evidence, e.g. a report, an investigation, etc;
- A *typical candidate at grades GG to EE etc. will*: – this describes the quality of the work a candidate needs to demonstrate in order to achieve the grades specified.

Guidance for teachers

This provides advice on teaching and assessment strategies.

There will be advice on:

- the provision of the vocational context of the unit;
- accurate and consistent interpretation of national standards;
- the use of appropriate internal assessments, taking into account the full range of grades to be covered.

There may also be advice on:

- exploiting local opportunities (e.g. information sources, events, work experience);
- resources.

Key Skills guidance

This signposts opportunities for developing and assessing Key Skills within the unit.

6 Unit 1: Designing Products for Manufacture

6.1 ABOUT THIS UNIT

In this unit you will gain an understanding of how manufacturing industry brings a product to the market place, by working from a client's design brief for a product. You will develop a design specification for a product, develop design and manufacturing proposals and draw up a final design and manufacturing solution. You will learn how to present your design solutions to a client and how to respond to feedback by modifying your design and manufacturing proposal accordingly.

You will learn about:

- product requirements and constraints;
- production details and constraints;
- material details and constraints;
- developing design ideas;
- scientific principles;
- presenting design solutions;
- modifying design solutions.

This and other units will utilise prior learning in design and technology. There are links between this unit and the production processes covered in Unit 2: *Manufactured products*, as the development of design solutions must show an understanding of how the product would be manufactured. Your design ideas may also use some of the knowledge from Unit 3: *Application of technology*. This unit may also help you to progress to VCE Manufacturing.

This unit also provides some the underpinning knowledge and understanding for the National Vocational Qualification in Performing Manufacturing Operations.

You will also have the opportunity to develop your Key Skills when working towards this unit.

*You should be **selective** and include in your portfolio work from this unit that **meets the evidence requirements**.*

This unit is assessed solely through portfolio assessment.

6.2 WHAT YOU NEED TO LEARN

6.2.1 Design Briefs

The design brief tells you the client's requirements. Before you start to produce design proposals, you must understand your client's needs.

The client's brief will usually specify a product's:

- function – where and what the product will be used for;
- performance – how well the product has to perform;
- intended markets – who might use the product, competition with other similar products, client's own customer base;
- quantity – how many are required;
- styling/aesthetic appearance – the product's appearance and appeal;
- quality standards – client and/or sector standards;
- cost – factory gate, retail cost;
- timescales.

6.2.2 Product Design Specifications

Before you can develop a design proposal, you need to pick out key features from the client design brief and research detailed information on each one. It is worth remembering that most design briefs are about adapting existing products rather than inventing new ones.

Designers use product design specifications to develop a proposal for how the product should be manufactured, how much it might cost and what it will be like. It allows them to judge if their ideas are likely to deliver a successful product. You will learn how to develop a product design specification which will include:

- product design details;
- material details and constraints;
- production details, constraints and quality standards.

6.2.3 Material Details and Constraints

You will draw upon your knowledge, experience and understanding of materials, components and ingredients in order to decide which are most appropriate for your design and manufacturing proposals. When comparing materials, components and ingredients you will need to consider the following:

- their availability, form and supply;
- their properties, characteristics and performance;
- their cost;
- health, safety and hygiene requirements;
- handling and storage.

6.2.4 Production Details and Constraints

One of the important factors that you will need to consider is the most cost effective and efficient way to manufacture the product. Factors to consider might include:

- labour – are there enough staff? Do they have the right skills or training?
- materials and components – what are the properties and features of materials and components that make them suitable for certain processes? Can they be bought in?
- available technology – what is the most appropriate technology for a particular process and material?
- health, safety and hygiene – when and where is it important in the production process?
- quality standards required by the customer and/or the sector – is a special material quality required?

Researching how leading manufacturing companies run their production lines as cost effectively as possible will help you to do this for your own products.

6.2.5 Quality Standards

You must understand the importance of sector specific standards and other aspects of quality that the client may refer to in the design brief. Quality standards included in the product design specification might relate to:

- level of output during production;
- level of performance for the product;
- the materials, components, ingredients to be used in production;
- tolerance in relation to characteristics such as size, weight, composition, density and viscosity;
- product finish, packaging and presentation;
- health, safety and hygiene standards.

6.2.6 Developing Design Ideas

You must know how to use the product design specification to develop initial ideas for how the product could be manufactured and how it might meet the client design brief. Your ideas should be developed around the key features, production and material constraints and quality standards in the product design specification.

You must know how to use the following techniques to help you *work up* initial design ideas:

- researching and analysing existing products, materials and manufacturing processes and market need;
- discussing your ideas with others;
- freehand sketching of ideas;
- modelling and testing ideas;
- developing and testing samples and prototypes.

You must be able to use ICT applications in addition to manual techniques to model and test design ideas and solutions.

Each design idea must contain information about the following:

- production – the most suitable process, tools, equipment and machinery;
- materials – their size, properties, characteristics and suitability for manufacturing processes;
- cost – of materials, resources and production processes and estimated cost of each item;
- market – type and size;
- quality standards – for finish, tolerances, performance and quality of material.

You must be able to explain any restrictions on the use of materials and methods you have included in your design ideas. For example, you might say that if the client wants the product to be a certain size, new equipment would need to be bought and that would add to the cost.

From your initial design ideas, you will need to choose the one you think best meets the client design brief. This process should be based upon all available criteria as you will be expected to justify your choice of design solution.

6.2.7 Presenting your Design Solution

You must learn how to present your chosen design solution to the client effectively. The presentation is your chance to explain and *sell* your proposal to the client and it is their chance to comment on your solution. To be effective, you must show how the work you have done to develop the design solution meets the client design brief.

The presentation must explain:

- the key features of the solution, including information about production and materials constraints;
- how you met the client design brief, including how your design will conform to quality standards;
- what research you have carried out.

To present your design solution you will need to choose and use suitable presentation techniques. These may include:

- fully annotated freehand sketches and drawings;
- photographs and ICT generated images;
- samples and swatches;
- technical drawings and diagrams;
- written material;
- spoken explanations;
- mock-ups, models and prototypes.

You should use appropriate ICT applications to develop and make your presentation.

6.2.8 Modifying Design Solutions

You must know how to respond to feedback from your client about your design solution. For example, you might need to change your design solution, or you might need to explain it in more detail. Your final, modified design proposal will need to reflect both the client's needs and the research you have done on the best way to manufacture the product.

6.3 ASSESSMENT EVIDENCE FOR UNIT 1: DESIGNING PRODUCTS FOR MANUFACTURE

You need to produce evidence in your portfolio of a product design specification and a design solution for a manufactured product, working from a customer design brief. Your design specification and design solution **must** include:

a details of the customer design brief, the design specification and associated information [9 marks];

b information about how you developed a design solution from your design specification [7 marks];

c the stages of manufacture and related quality control procedures including health and safety issues, that will be used to make a batch of your product [9 marks];

d how you communicated your selected design solution to the customer, by developing sketches, notes and working drawings [10 marks];

e consideration of how to manufacture your selected design solution, identifying the manufacturing processes and quality standards that would be used to produce your product **in quantity** [15 marks].

A typical candidate at grades GG, FF, EE will:	A typical candidate at grades DD, CC, BB will:	A typical candidate at grades BB, AA, A*A* will:	Mark	Max
a1 Produce a design specification from a given design brief. **0 1 2 3**	**a2** Produce a detailed design specification using customer feedback and associated information. **4 5 6**	**a3** Justify the final design specification by explaining how customer feedback and associated information were used. **7 8 9**		**9**
b1 Use their design specification to produce ideas for a design solution. **0 1 2 3**	**b2** Explain the use of their design specification in developing ideas for their final design solution. **4 5**	**b3** Fully justify their choice of a final design solution from a range of ideas. **6 7**		**7**
c1 Identify health and safety issues that arise in making their product. **0 1 2 3 4**	**c2** Identify the quality control procedures that would be used in each stage of making their product. **5 6 7**	**c3** Evaluate quality control, quality assurance and total quality management applied to making their product. **8 9**		**9**

d1 Use diagrams, sketches and other appropriate methods to present their design solution to the customer. **0 1 2 3 4 5**	**d2** Use diagrams, sketches and other appropriate methods, including modelling, to explain their design solution to the customer. **6 7 8**	**d3** Use diagrams, sketches, working drawings and other appropriate methods, including modelling, to justify their design solution to the customer. **9 10**		**10**
e1 Identify the manufacturing processes that would be used to produce their product in quantity. **0 1 2 3 4 5 6 7**	**e2** Identify the stages and associated quality assurances that will be used to manufacture their product. **8 9 10 11**	**e3** Evaluate and justify the stages and associated quality assurances they will use in the manufacture of their product, with particular reference to 'real world' manufacturing. **12 13 14 15**		**15**
Note: Although you will be given an interim mark out of 50 by your teacher, this might be adjusted by OCR to make sure that your mark is in line with national standards.			**Total**	**50**

6.4 GUIDANCE FOR TEACHERS

6.4.1 Guidance on Delivery

The work undertaken by candidates can be based in any of the sectors of manufacturing outlined in the specification. The majority of candidates will be able to develop skills they have learnt in KS3 Design and Technology, in order to satisfy the requirements of the assessment criteria.

Candidates should be encouraged to work in a manner similar to that employed in industry where this is appropriate. Role play and simulation exercises can prove useful, as can video or visits to industrial centres, in developing an awareness of manufacturing practices.

Candidates should be given the opportunity to work in a range of materials and components to design products for manufacture in any material area including food, textiles, resistant materials, paper and card. Using components from kits, such as lego, fischer technik, or ready made food components such as flan cases, will allow candidates to produce prototypes and models relatively easily. They can then go on to develop their ideas and, where necessary, produce alternatives to the pre-manufactured items.

The specification contains language that reflects the requirements of Manufacturing terminology. In order to ensure that the use of specialist terminology does not exclude candidates, key terms are explained below:

- **Food**
  The term *components* refers to the buying in of pre-prepared ingredients, e.g. ready-made pastry. The term *tools* refers to food preparation equipment and the term *materials* to food ingredients.
- **Graphics**
  The term *components* refers to the buying in of pre-prepared units, e.g. pre-printed packaging. The term *tools* refers to graphic equipment and the term *materials* to card, paper, board and similar graphics materials.
- **Engineering, Systems and Control**
  Systems candidates will be familiar with the terms *components, tools* and *equipment*. The term *materials* refers to circuit boards and similar base components.
- **Resistant Materials and Textiles**
  Resistant Materials and Textiles manufacturing candidates should be familiar with the terms *tools, materials* and *equipment*. Textiles candidates should understand the term *components* as purchased pre-printed materials, ready-made buttons, etc.

Candidates need to work with a brief. This should not be open-ended as, in industry, product design is rarely an open-ended practice. Candidates can then draw conclusions from the design brief and formulate a design specification. They should then go on to use this information in developing solutions to the design brief.

Candidates should be given the opportunity to work on a number of design briefs from different clients. This will enable them to develop skills in a number of areas, including communication, as well as in the use of the materials and components used to produce the solution. A single design brief may be limiting in this aspect.

The use of ICT should be encouraged throughout this unit, particularly in the presentation aspects. This will help candidates to achieve a professional standard and their presentations can then be evaluated by representatives of the sector for which the solution is aimed.

This unit can be taught with Unit 2: *Manufactured products* as candidates will need to understand how their design solutions can be manufactured and the constraints that the manufacturing sector can place upon the designer. This will also help candidates to assess the viability of their design solutions.

6.4.2 Guidance on Assessment

Coursework evidence can take a number of forms. A candidate portfolio can consist of any appropriate form of evidence, including teacher/tutor comments, photographs, taped and video evidence, supported witness statements and paper based evidence.

Where Centres are unable, for logistical reasons, to visit, or receive input from, local manufacturing companies, teachers/tutors should use video and simulations to give candidates a feel for industrial manufacturing processes.

When grading the portfolio for this unit you must consider the following general qualities which distinguish between grades. The candidate shows:

- increasing depth of understanding of the unit content, showing greater depth and breadth;
- increasing coherence, comparison and a greater ability to draw valid conclusions when designing;
- greater independence and originality of design ideas;
- increasing understanding of the design process;
- greater skills in utilising the design process.

Each portfolio should be marked by the teacher according to the criteria in the *Assessment Evidence Grid* in section 6.3. Photocopiable URS will be supplied and will be sent to Centres at the start of the course.

Each row in the grid comprises a strand showing the development of a given criterion, each row corresponding to a point (**a**, **b**, **c** etc.) in the banner.

Please note that the second column describes the work of a typical candidate working at grades DD, CC and *the lower half of grade BB* whilst the third column describes the work of a typical candidate working at *the upper half of grade BB*, grades AA and A*A*.

The maximum mark for each criteria strand is shown in the right hand column.

Teachers use their professional judgement and circle the mark that *best fits* the work of the candidate and also record it on the URS in the column headed *Mark*.

Centres should use the full range of marks available to them; Centres must award *full* marks in any band for work which fully meets the criteria. This is work which is 'the best one could expect from candidates working at GCSE (Double Award) level'.

Only one mark per strand/row will be entered. The final mark for the candidate is out of a total of 50 and is found by totalling the marks for each strand.

Example: For a candidate's work that comfortably satisfies criterion **e2** and may be perceived as equivalent to the work of a grade CC candidate, a mark of **10** should be awarded on the scale for this strand of 0-15.

A typical candidate at grades GG, FF, EE will:	**A typical candidate at grades DD, CC, BB will:**	**A typical candidate at grades BB, AA, A*A* will:**	**Mark**	**Max**
e1 Identify the manufacturing processes that would be used to produce their product in quantity. **0 1 2 3 4 5 6 7**	**e2** Identify the stages and associated quality assurances that will be used to manufacture their product. **8 9 (10) 11**	**e3** Evaluate and justify the stages and associated quality assurances they will use in the manufacture of their product, with particular reference to 'real world' manufacturing. **12 13 14 15**	**10**	**15**

The following table indicates which criteria in the *Assessment Evidence Grid* meet which assessment objectives:

Criterion	AO1	AO2	AO3
a1	4	4	8
a2	4	4	4
a3	4	4	4
b1	8	8	4
b2	4	4	4
b3	4	4	4
c1	4	8	8
c2	4	4	8
c3	4	4	4
d1	4	8	4
d2	4	8	4
d3	4	4	4
e1	8	4	8
e2	4	4	8
e3	4	4	4

6.4.3 Resources

Equipment

To fulfil this unit candidates will need access to a range of drawing tools including drawing boards and ancillary equipment. Sketching and drawing media, e.g. pencils, crayons, drawing pens are a requirement of the course plus wherever possible ICT access with CAD programs. They will also require access to real life examples of manufactured products and design ideas.

Manufacturing Companies

Ideally candidates should visit local manufacturing companies. These companies could be from any manufacturing area including food, textiles, electronics or engineering. It is important to ensure that they fully understand the difference between *one off* production in a school or college workshop and manufacturing a product for sale. Where this is not possible, video, books and visits from external speakers will be necessary.

Teaching Skills

Resistant Materials, Food, Textiles and Graphic Product teachers will be ideal for the delivery of this course. They will need to have a growing understanding of manufacturing within their subject area and will need to reinforce the differences between manufacturing *one off* products and working in a team to produce a manufactured product in batches or by mass production methods.

Books

For *all* candidates:

Design in the Making; Longman
A book with a Teachers Guide aimed essentially at 11-14 year olds, but with a quantity of useful information and worksheets suitable for GCSE in Manufacturing (Double Award) at Key Stage 4.

Books are available covering Resistant Materials ISBN 0582 36589 9 (Teachers Pack, ISBN 0582 36587 2), Textiles ISBN 0582 34437 9 (Teachers Pack, ISBN 0582 34438 7) and Food Technology ISBN 0582 36590 2 (Teachers Pack, ISBN 0582 36588 0).

Royal College of Art Routes series; Hodder and Stoughton

A series of books and Teachers Guides aimed at Key Stages 3 and 4 (Food ISBN 0340 67392 3, Textiles ISBN 0304 67391 5, Graphics ISBN 0304 67393 1, Control ISBN 0304 67390 7, Resistant Materials ISBN 0304 67394 X) and post-16 (ISBN 0-340-70528-0) containing useful information for GNVQ candidates across all material areas, including examples from various manufacturing industries.

Design & Make It! Resistant Materials Technology; Stanley Thornes ISBN 0 7487 2470 2
This book has been designed essentially to support GCSE Design and Technology but provides a good foundation in the use of resistant materials.

For more advanced candidates and teachers:

Advanced Manufacturing Design & Technology; Hodder & Stoughton.
A book developed by the Royal College of Art Technology Project, aimed at VCE and A level candidates of manufacturing and engineering. ISBN 0 340 70528 0.

Manufacturing Technology; Delmar Publishers Inc.
An American candidates' book offering a broad approach to issues across manufacturing technologies. Care needs to be taken as measurements and financial data are in US units. ISBN 0 8273 3462 1.

Fundamentals of Engineering, author R.L. Timings; Longman.
A book aimed at NVQ Engineering candidates. It has some good practical content. ISBN 0 282 30583 7

Engineers in Business, author Mike Lanigan; Addison Wesley Publishing.
This is a book aimed at degree level candidates, but contains a large amount of useful information. ISBN 0 201 41695 6.

6.4.4 Key Skills Mapping

Details on delivery are given in Section 4.

🔑 this unit contains clear opportunities for generating Key Skills portfolio evidence.
∫ this unit contains opportunities for developing the Key Skill, and possibly for generating portfolio evidence if teaching and learning is focused on that aim.
8 there are no obvious opportunities for the development or assessment of the Key Skill in this unit.

Criterion	C	N	IT	WO	PS	LP
1.1	🔑	∫	∫	∫	🔑	∫
1.2	∫	🔑	∫	∫	🔑	∫
1.3	🔑	🔑		∫	🔑	∫
2.1	🔑	∫	∫	∫	🔑	∫
2.2 (a) **(b)** **(c)** **(d)**	∫	🔑 🔑 🔑 ∫	∫	∫	🔑	∫
2.3	🔑	🔑	∫	∫	🔑	∫

7 Unit 2: Manufactured Products

7.1 ABOUT THIS UNIT

In this unit you will work as part of a team to manufacture a quantity of products. You will learn:

- how to use a production plan;
- how to develop a schedule for manufacture;
- how to use and apply quality control techniques;
- how to record and respond to quality data;
- how to use tools, equipment, including Computer Aided Manufacture (CAM), and machinery safely;
- about tools, equipment, materials and processes;
- what makes an effective team.

This and other units will utilise prior learning in design and technology. This unit links with Unit 3: *Application of technology* and Unit 1: *Designing products for manufacture* as you will be able to put what you have learnt about design and new technology into practice when manufacturing your own products. This unit may also help you to progress to VCE Manufacturing.

This unit also provides some of the underpinning knowledge and understanding for the National Vocational Qualification in Performing Manufacturing Operations.

You will also have the opportunity to develop your Key Skills when working towards this unit.

*You should be **selective** and include in your portfolio work from this unit that **meets the evidence requirements**.*

This unit is assessed solely through portfolio assessment.

7.2 WHAT YOU NEED TO LEARN

7.2.1 Production Plans and Schedule for Manufacture

Production plans provide information about the type and quantity of product to be manufactured, such as single unit, batch and volume production. You will learn how to use a given production plan to develop a realistic schedule for manufacture. A schedule for manufacture should include the following information:

- all preparation, processing and assembly stages;
- the sequence and timing of stages;
- critical production and quality control points;
- production and quality control procedures;
- allocation of roles and responsibilities.

You will also learn how to modify the production plan and schedule for manufacture as circumstances change.

7.2.2 Teamwork

You must understand what makes an effective team. You will learn how an effective team can be built through:

- allocating and agreeing roles and responsibilities, based on the strengths and weaknesses of team members;
- setting and agreeing individual and team targets;
- ensuring good communication between team members;
- ensuring that team members are motivated;
- creating an appropriate working environment.

7.2.3 Preparing Materials, Components, Ingredients, Tools, Equipment and Machinery

You must understand the function of each component and must know how to prepare materials, ingredients and components according to the production plan and schedule for manufacture. You will need to recognise that some parts, components and ingredients are purchased already manufactured and ready for inclusion in the product. You will need to learn about the processing methods for given materials and their working properties to achieve optimum use of materials.

You must be aware of other forms of materials, component and ingredient preparation such as trimming, cleaning or degreasing, preparing blanks and initial processing such as annealing or freezing.

You must be able to select, prepare and use tools, equipment and machinery needed for the manufacture of a product. This includes cleaning and setting up, for example checking cutting edges, tensioning sewing machines.

You must be able to carry out health, safety and hygiene checks on tools, equipment and machinery, for example checking guards are in position.

7.2.4 Processing Materials and Components

You must learn how to use appropriate tools, equipment, including Computer Aided Manufacture (CAM), and machinery safely and use manufacturers' instructions to produce a given product. To do this you must be able to:

- control and adjust appropriate equipment and machinery correctly to process materials, components/ingredients to specification, and quality standards;
- maintain levels of materials and resources;
- understand the principles that determine the correct use of tools, equipment and machinery.

7.2.5 Combining, Assembling and Finishing Materials and Components/Ingredients

You must be able to combine, assemble and finish materials, components and ingredients to a production plan and schedule for manufacture in order to meet client requirements and conform to quality standards.

7.2.6 Applying Quality and Production Control Techniques during Manufacture

You must understand about quality indicators given in the production plan and be able to apply these during manufacture. You must be able to:

- inspect, test and compare (as required) samples of the product material, component/ingredient at the critical control points specified in your schedule for manufacture;
- record data in appropriate formats, using manual techniques or ICT applications;
- identify variances from the quality standards and suggest possible causes and changes needed to prevent them from happening again;
- monitor the progress of production and identify, record and remedy any variance from the schedule for manufacture.

7.2.7 Health, Safety and Hygiene

When manufacturing a product, you must always be aware of health, safety and hygiene issues relating to the use of materials, components, ingredients, tools and equipment. You must be able to:

- carry out a risk assessment;
- care for yourself and others in a manufacturing environment;
- follow safety procedures and instructions;
- keep a safe place of work;
- check that safety equipment, health, safety and hygiene procedures and systems are operational;
- use safety equipment and health, safety and hygiene procedures and systems correctly during combining, assembly and finishing.

Safety systems include guards or stop buttons, as well as procedures to ensure hygiene standards are met.

Safety equipment includes emergency equipment, first-aid equipment and personal safety, including clothing.

7.3 ASSESSMENT EVIDENCE FOR UNIT 2: MANUFACTURED PRODUCTS

You need to produce evidence in your portfolio of the production of a batch of a product, manufactured by a team. The manufactured product must have at least **three** components/ingredients. Your portfolio **must** include:

a evidence of a production plan, identifying the manufacturing processes and associated quality control [9 marks];

b a schedule for manufacture with the key features identified [7 marks];

c a detailed description of the production technique and critical control points [9 marks];

d an outline of team roles and effective team structure [10 marks];

e a record of how you manufactured your product [15 marks].

A typical candidate at grades GG, FF, EE will:	A typical candidate at grades DD, CC, BB will:	A typical candidate at grades BB, AA, A*A* will:	Mark	Max
a1 Describe a simple manufacturing process using ICT as appropriate. **0 1 2 3**	**a2** Produce a production plan that identifies the manufacturing processes and quality control. **4 5 6**	**a3** Evaluate their production plan, in relation to manufacturing processes and quality control. **7 8 9**		**9**
b1 Describe the importance of accurate production planning and of meeting the product specification. **0 1 2 3**	**b2** Identify in their production plan the schedule for manufacture and allocate roles to team members. **4 5**	**b3** Evaluate their production plan in terms of how the schedule for manufacture could be improved and why particular roles were allocated to particular team members. **6 7**		**7**
c1 Identify key control points during manufacture and describe the importance of health and safety. **0 1 2 3 4**	**c2** Use quality control tests and carry out work with due regard to health and safety, including reference to appropriate safety systems. **5 6 7**	**c3** Explain and justify how the production planning and scheduling could be improved to encompass total quality management and appropriate safety systems. **8 9**		**9**

d1 Describe the features of good teamwork in the manufacture of a product. **0 1 2 3 4 5**	**d2** Identify effective teamwork for different aspects of manufacture, identifying key roles during the preparation of materials, components, equipment and machinery in the manufacture of their product. **6 7 8**	**d3** Explain methods of improving the production of their product by more effective use of the manufacturing team and through improvements that could be made as a result of buying in ingredients or components. **9 10**		**10**
e1 Describe how they produced their product using appropriate tools and equipment. **0 1 2 3 4 5 6 7**	**e2** Explain why the tools and equipment used were appropriate to the task and identify any changes they have made to their production plan. **8 9 10 11**	**e3** Evaluate their product in terms of the tools, equipment and processes they have used and comment on how these would be modified in 'real world' manufacturing. **12 13 14 15**		**15**
Note: Although you will be given an interim mark out of 50 by your teacher, this might be adjusted by OCR to make sure that your mark is in line with national standards.			**Total**	**50**

7.4 GUIDANCE FOR TEACHERS

7.4.1 Guidance on Delivery

The work undertaken by candidates can be based in any of the sectors of manufacturing outlined in the specification. The majority of candidates will be able to develop skills they have learnt in KS3 Design and Technology, in order to satisfy the requirements of the assessment criteria.

Candidates must be presented with a suitable design brief and specification which will allow them to produce a manufacturing production plan of appropriate complexity. The specification differs from *Design and Technology* in that the candidate simulates a real manufacturing situation. This can take the form of a small or large organisation ranging from a local baker or fashion shop through to a large scale manufacturing company. The important learning aim is for the candidate to understand the differences between one-off manufacture and manufacturing as part of a team.

Candidates should be encouraged to work in a manner similar to that employed in industry where this is appropriate. Role play and simulation exercises can prove useful, as can video or visits to industrial centres, in developing an awareness of manufacturing practices.

The product should have a number of components, preferably manufactured from different materials, and must be relatively simple to manufacture within the constraints of the Centre.

The specification contains language that reflects the requirements of Manufacturing terminology. In order to ensure that the use of specialist terminology does not exclude candidates, key terms are explained below:

- **Food**
  The term *components* refers to the buying in of pre-prepared ingredients, e.g. ready-made pastry. The term *tools* refers to food preparation equipment and the term *materials* to food ingredients.
- **Graphics**
  The term *components* refers to the buying in of pre-prepared units, e.g. pre-printed packaging. The term *tools* refers to graphic equipment and the term *materials* to card, paper, board and similar graphics materials.
- **Engineering, Systems and Control**
  Systems candidates will be familiar with the terms *components, tools* and *equipment*. The term *materials* refers to circuit boards and similar base components.
- **Resistant Materials and Textiles**
  Resistant Materials and Textiles manufacturing candidates should be familiar with the terms *tools, materials* and *equipment*. Textiles candidates should understand the term *components* as purchased pre-printed materials, ready-made buttons, etc.

The design specification should be clear and meaningful, with appropriate constraints and limitations.

The choice of product is important as it must stimulate candidates and therefore be interesting to them.

A production plan can be given to candidates as a starting point. The more able candidates will then develop their own, choosing tools, equipment and processes made available to them. The plan must be clear and unambiguous and, where possible, related to industrial practices.

Candidates should work in teams. This means that the plan must allow for different roles to be carried out at certain times. The use of job cards can prove helpful in organising candidates' work patterns.

Throughout the practical activities, candidates must be given clear guidance and instruction on relevant health and safety issues.

7.4.2 Guidance on Assessment

Coursework evidence can take a number of forms. A candidate portfolio can consist of any appropriate form of evidence, including teacher/tutor comments, photographs, taped and video evidence, supported witness statements and paper based evidence.

Where Centres are unable, for logistical reasons, to visit, or receive input from, local manufacturing companies, teachers/tutors should use video and simulations to give candidates a feel for industrial manufacturing processes.

When grading the portfolio for this unit you must consider the following general qualities which distinguish between grades. The candidate shows:

- increasing depth of understanding of the unit content, showing greater depth and breadth;
- increasing coherence, comparison and a greater ability to draw valid conclusions when designing;
- greater independence and originality of design ideas;
- increasing understanding of the manufacturing process;
- greater skills and confidence in using manufacturing processes, production plans and a manufacturing schedule.

Each portfolio should be marked by the teacher according to the criteria in the *Assessment Evidence Grid* in section 7.3. Photocopiable URS will be supplied and will be sent to Centres at the start of the course.

Each row in the grid comprises a strand showing the development of a given criterion, each row corresponding to a point (**a**, **b**, **c** etc.) in the banner.

Please note that the second column describes the work of a typical candidate working at grades DD, CC and *the lower half of grade BB* whilst the third column describes the work of a typical candidate working at *the upper half of grade BB*, grades AA and A*A*.

The maximum mark for each criteria strand is shown in the right hand column.

Teachers use their professional judgement and circle the mark that *best fits* the work of the candidate and also record it on the URS in the column headed *Mark*.

Centres should use the full range of marks available to them; Centres must award *full* marks in any band for work which fully meets the criteria. This is work which is 'the best one could expect from candidates working at GCSE (Double Award) level'.

Only one mark per strand/row will be entered. The final mark for the candidate is out of a total of 50 and is found by totalling the marks for each strand.

Example: For a candidate's work that comfortably satisfies criterion **e2** and may be perceived as equivalent to the work of a grade CC candidate, a mark of **10** should be awarded on the scale for this strand of 0-15.

A typical candidate at grades GG, FF, EE will:	**A typical candidate at grades DD, CC, BB will:**	**A typical candidate at grades BB, AA, A*A* will:**	**Mark**	**Max**
e1 Describe how they produced their product using appropriate tools and equipment. **0 1 2 3 4 5 6 7**	**e2** Explain why the tools and equipment used were appropriate to the task and identify any changes they have made to their production plan. **8 9 (10) 11**	**e3** Evaluate their product in terms of the tools, equipment and processes they have used and comment on how these would be modified in 'real world' manufacturing. **12 13 14 15**	**10**	**15**

The following table indicates which criteria in the *Assessment Evidence Grid* meet which assessment objectives:

Criterion	AO1	AO2	AO3
a1	4	4	8
a2	4	4	8
a3	4	4	4
b1	4	8	4
b2	4	4	4
b3	4	4	4
c1	4	8	8
c2	4	8	8
c3	4	4	4
d1	4	8	4
d2	4	4	4
d3	4	4	4
e1	4	4	8
e2	4	4	4
e3	4	4	4

7.4.3 Resources

Equipment

To fulfil this unit candidates will need access to a range of manufacturing tools appropriate to the material areas studied. Normal workshop and food equipment will be suitable but candidates are expected to understand batch production so equipment such as a bread maker, ice cream maker, vacuum former etc. will be required. They will require access to raw materials and ready-made components/ingredients. They will also require access to real life examples of manufactured products and design ideas.

Manufacturing Companies

Ideally candidates should visit local manufacturing companies. These companies could be from any manufacturing area including food, textiles, electronics or engineering. It is important to ensure that they fully understand the difference between *one off* production in a school or

college workshop and manufacturing a product for sale. Where this is not possible, video, books and visits from external speakers will be necessary.

Teaching Skills

Resistant Materials, Food, Textiles and Graphic Product teachers will be ideal for the delivery of this course. They will need to have a growing understanding of manufacturing within their subject area and will need to reinforce the differences between manufacturing *one off* products and working in a team to produce a manufactured product in batches or by mass production methods.

Books

For *all* candidates:

Design in the Making; Longman
A book with a Teachers Guide aimed essentially at 11-14 year olds, but with a quantity of useful information and worksheets suitable for GCSE in Manufacturing (Double Award) at Key Stage 4.

Books are available covering Resistant Materials ISBN 0582 36589 9 (Teachers Pack, ISBN 0582 36587 2), Textiles ISBN 0582 34437 9 (Teachers Pack, ISBN 0582 34438 7) and Food Technology ISBN 0582 36590 2 (Teachers Pack, ISBN 0582 36588 0).

Royal College of Art Routes series; Hodder and Stoughton

A series of books and Teachers Guides aimed at Key Stages 3 and 4 (Food ISBN 0340 67392 3, Textiles ISBN 0304 67391 5, Graphics ISBN 0304 67393 1, Control ISBN 0304 67390 7, Resistant Materials ISBN 0304 67394 X) and post-16 (ISBN 0-340-70528-0) containing useful information for GNVQ candidates across all material areas, including examples from various manufacturing industries.

Design & Make It! Resistant Materials Technology; Stanley Thornes ISBN 0 7487 2470 2
This book has been designed essentially to support GCSE Design and Technology but provides a good foundation in the use of resistant materials.

For more advanced candidates and teachers:

Advanced Manufacturing Design & Technology; Hodder & Stoughton.
A book developed by the Royal College of Art Technology Project, aimed at VCE and A level candidates of manufacturing and engineering. ISBN 0 340 70528 0.

Manufacturing Technology; Delmar Publishers Inc.
An American candidates' book offering a broad approach to issues across manufacturing technologies. Care needs to be taken as measurements and financial data are in US units. ISBN 0 8273 3462 1.

Fundamentals of Engineering, author R.L. Timings; Longman.
A book aimed at NVQ Engineering candidates. It has some good practical content. ISBN 0 282 30583 7

Engineers in Business, author Mike Lanigan; Addison Wesley Publishing.
This is a book aimed at degree level candidates, but contains a large amount of useful information. ISBN 0 201 41695 6.

7.4.4 Key Skills Mapping

Details on delivery are given in Section 4.

🔑 this unit contains clear opportunities for generating Key Skills portfolio evidence.
∫ this unit contains opportunities for developing the Key Skill, and possibly for generating portfolio evidence if teaching and learning is focused on that aim.
8 there are no obvious opportunities for the development or assessment of the Key Skill in this unit.

Criterion	C	N	IT	WO	PS	LP
1.1	∫	🔑	∫	🔑	🔑	∫
1.2	🔑	🔑	∫	🔑	🔑	∫
1.3	∫	🔑		∫	∫	∫
2.1	∫	🔑	∫	🔑	🔑	∫
2.2 (a) **(b)** **(c)** **(d)**	🔑	🔑 🔑 🔑 ∫	🔑	🔑	🔑	∫
2.3	∫	🔑	∫	∫	∫	∫

8 Unit 3: Application of Technology

8.1 ABOUT THIS UNIT

Technology affects every stage in the design and manufacture of products. In this unit you will investigate the impact of modern technology on the design and manufacture of a range of products in different engineering and manufacturing sectors. You will learn how new technology has helped to develop design and manufacturing processes and to improve the quality of products and the service offered to customers. You will also learn about the benefits and implications modern technology has for the work force, the wider community, the global environment and sustainability.

You will investigate the impact of:

- information and communications technology (ICT);
- new components and a range of modern materials, including smart materials;
- control technology.

This and other units will utilise prior learning in design and technology. This unit links with Unit 1: *Design and graphical communication* and Unit 2: *Engineered products* where you will have the opportunity to use new technology and materials. This unit may also help you to progress to VCE Engineering or VCE Manufacturing. This unit also forms part of the GCSE in Manufacturing (Double Award).

This unit provides some of the underpinning knowledge and understanding for the National Vocational Qualification in Performing Manufacturing Operations and Performing Engineering Operations.

You will also have the opportunity to develop your Key Skills when working towards this unit.

This unit is assessed solely through an externally set test.

8.2 WHAT YOU NEED TO LEARN

8.2.1 Manufacturing and Engineering Sectors

You will investigate the impact of technology on the design and manufacture of different products across a range of the manufacturing and engineering sectors listed below:

Manufacturing	Engineering	
biological and chemical	aeronautical	fluid
engineering fabrication	automotive	marine
food and drink	civil	mechanical
paper and board	computer	process control
printing and publishing	construction	telecommunications
textiles and clothing	electrical and electronic	

When investigating products, you must be able to identify in which sector the product was made.

8.2.2 New Technology

You will learn about, and look at examples of, how modern technology is involved in the design and manufacture of a range of products across the different sectors. The modern technologies you will learn about are:

The Use of Information and Communications Technology, including:

- sourcing and handling information and data, such as databases, spreadsheets and internet sites;
- CAD (computer-aided design) techniques;
- CAM (computer-aided manufacture);
- communications technology;
- control technology.

The Use of Modern and Smart Materials and Components, including:

- polymers, including plastics, adhesives and coatings;
- metals and composites, including shape memory alloys;
- biological, chemical and food products, modified ingredients and methods of preparation and production;
- computer technology, including microprocessors and memory devices;
- micro-electronic components and parts, including integrated circuits and display devices;
- textile technology, including liquid crystal coated fabrics and thermocromic dyes.

The Use of Systems and Control Technology to Organise, Monitor and Control Production, including:

- process/quality control and automation, including programmable logic controllers (PLCs) and embedded computers such as those used in both industrial and domestic appliances;
- robotics, including continuous operation, improved reproducibility, increased speed, work in hazardous environments;
- ICT as applied to integrated manufacturing/engineering systems, computer integrated engineering (CIE), computer integrated manufacturing (CIM) and including CAD/CAM links.

You must understand the impact of these modern technologies on:

- range, types and availability of products;
- design and development of products;
- materials, components and ingredients used;
- safety and efficiency of modern methods of production in terms of materials, energy consumption and time;
- improved characteristics of products, such as size, weight/density, ease of use, disposability and reclaimability;
- markets for the products.

You must also understand the advantages and disadvantages that the use of modern technology has brought to society. These might include:

- changes in the type and size of the workforce;
- changes in the working environment;
- impact on the global environment and sustainability.

8.2.3 Stages in Engineering and Manufacturing a Product

Making a product involves a number of important stages and activities. These can be generally grouped as:

- design;
- marketing;
- production planning;
- material supply and control;
- processing – production;
- assembly and finishing;
- packaging and dispatch.

When you look at a product, you must be able to identify the main stages and activities in making the product.

You also need to understand the impact of modern technology on the stages of manufacturing.

8.2.4 Investigating Products

You will learn how to investigate products from a variety of sectors that use modern technology by:

- researching information from manufacturers and suppliers;
- handling and examining individual products;
- carrying out simple assessment of properties, such as structure, heaviness, colour and feel of surfaces, scratch and wear resistance, areas likely to be damaged;
- evaluating the need for the technology, materials and components used.

When investigating the impact of technology on the design and manufacture of a range of products in different sector, you should consider:

- the role the modern technology plays in the design and manufacture of the product;
- the technology or process it replaced;
- the benefits of using the technology;
- the implications of using the technology for the product and the manufacturer.

You must be able to use the information you have gathered, together with drawings, diagrams and sketches, to explain how a product works in terms of its:

- purpose;
- structure and form;
- materials and components;
- technology used.

8.3 GUIDANCE FOR TEACHERS

8.3.1 Guidance on Delivery

The examination paper is common to both the GCSE in Engineering (Double Award) and the GCSE in Manufacturing (Double Award). This allows Centres flexibility to co-teach the two specifications. Where Centres decide to co-teach two groups in this way, engineering candidates will focus on the use of engineering materials, material removal, joining, assembly, treatment processes and surface finishes. Manufacturing candidates will focus on the production of made products in one or more material areas from: food, textiles, paper and card, chemicals, resistant materials and ceramics.

Candidates will be expected to answer questions to show how well they understand the importance of technology in manufacturing and engineering. Their answers will need to include:

- information relating to the sectors outlined in the unit specification;
- information detailing an investigation into products manufactured from one or a number of the sectors;
- new materials and how they can be used;
- the use of ICT in the manufacturing process including CAD and CAM;
- details of the impact the product(s) they have investigated have had upon the manufacturer, user and other sectors of manufacturing/engineering;
- details of the different methods of production used in the sectors outlined in the specification of this unit.

8.3.2 Resources

For *all* candidates:

ICT textbooks:

Heinemann OCR ICT B; ISBN 0 435 45496 X. This text book has been written to explore vocational use of ICT and contains some useful information on contexts. The book is supported by a teacher pack.

Hodder & Stoughton GCSE in Information and Communication Technology (Double Award); this book is to be published in June 2002, essentially to support the GCSE in Information and Communication Technology (Double Award) offered by the awarding bodies. Again, while not being specific to manufacturing and engineering, the book provides a useful resource for vocational use of ICT.

Design and technology books:

Design in the Making; Longman
A book with a Teachers Guide aimed essentially at 11-14 year olds, but with a quantity of useful information and worksheets suitable for GCSE in Manufacturing (Double Award) at Key Stage 4.

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Manufacturing Technology; Delmar Publishers Inc.
An American candidates' book offering a broad approach to issues across manufacturing technologies. Care needs to be taken as measurements and financial data are in US units. ISBN 0 8273 3462 1.

Fundamentals of Engineering, author R.L. Timings; Longman.
A book aimed at NVQ Engineering candidates. It has some good practical content. ISBN 0 282 30583 7.

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8 there are no obvious opportunities for the development or assessment of the Key Skill in this unit.

Criterion	C	N	IT	WO	PS	LP
1.1	∫	∫	∫	8	8	8
1.2(a) 1.2(b) 1.2(c)	∫	🔑 ∫ 🔑	∫			
1.3	∫	∫				
2.1	∫	∫	∫	8	8	8
2.2 (a) (b) (c) (d)	∫	🔑 ∫ 🔑 ∫	∫			
2.3	∫	∫	∫			