

# Introduction

The GCSE in **Manufacturing** (Double Award) is a vocational GCSE that is equivalent upon completion to two GCSE's.

It has been designed to provide a broad educational basis for further training, for further education or for moving into employment within the manufacturing sector.

The course itself consists of three compulsory units which are equally weighted. Two units are assessed 'internally' by the student producing assignments to cover investigation and analysis of manufacturing processes. The third unit is assessed externally through a written test.

All three units require students to investigate manufacturing businesses. However Units 1 & 2 require the students to follow manufacturing practices and to be able to compare and contrast different manufacturing businesses which would significantly help their work.

## Unit 1

**DESIGNING PRODUCTS FOR MANUFACTURE** introduces the student to design briefs, material and production details and constraints, quality standards and presenting design solutions.

## Unit 2

**MANUFACTURED PRODUCTS** requires the student to produce a production plan and schedules for manufacturing, preparation, applying quality and production control techniques during manufacture.

This new GCSE started in September 2002 and teachers are under great pressure to arrange visits and speakers to allow their students access to the information they require. Simulated exercises have a limited role in this qualification; the aim is to immerse the students and teachers in the actual working environment they are studying.

This guidance should help provide EBPs and employers with an understanding of the issues and level of depth that needs to be covered to enable students to specifically meet the requirements for their coursework.

# Unit 1

## Designing Products for Manufacture

The designing products unit in the **Manufacturing** GCSE introduces the student to six main themes:

- DESIGN BRIEFS
- PRODUCT DESIGN SPECIFICATIONS
- MATERIAL AND PRODUCTION DETAILS AND CONSTRAINTS
- QUALITY STANDARDS
- DEVELOPING DESIGN IDEAS AND MODIFYING DESIGN SOLUTIONS
- PRESENT DESIGN SOLUTIONS

## DESIGN BRIEFS

### *Explanation of Term*

A design brief states the client's requirements. The 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
- Quantity
- Styling/aesthetic appearance
- Quality standards
- Cost
- Timescales

### *Factor/Evidence*

Any briefs that the company has received from customers.

### *Types of Companies*

- Food manufacturers
- Clothes manufacturers
- Car manufacturers

# Unit 1

## *Generic examples of questions for companies*

- How many design briefs on average would the company receive over a year?
- What do most design briefs look like?
- What proportion of design briefs are variations on existing products?
- What sort of work do you do to respond to them?
- Who gets involved in responding to a brief?
- Do you help your customers to build a design brief? Do you have a standard structure that you like them to follow?
- What makes a good design brief? Can you share an example?

## **PRODUCT DESIGN SPECIFICATIONS**

### *Explanation of Term*

Product design specifications are used to develop a proposal for how the product should be manufactured, how much it might cost and what it will be like.

Most design briefs are about adapting existing products rather than inventing new ones.

### *Factors/Evidence*

Product design details, material details and constraints and production details, constraints and quality standards.

### *Types of Companies*

See above.

## *Generic examples of questions for companies*

- What should all product design briefs contain?
- What are the most important things you consider when you are drawing up a product design specification?
- Who gets involved in putting together a product design specification?
- How do you establish the key features in a design brief?

# Unit 1

## MATERIAL AND PRODUCTION DETAILS AND CONSTRAINTS

### *Explanation of Term*

Material and production details and constraints need to be considered when replying to briefs.

When comparing materials, components and ingredients the following need to be considered:

- Their availability, form and supply
- Their properties, characteristics and performance
- Their cost
- Health, safety and hygiene requirements
- Handling and storage

Production factors to consider might include:

- Labour – are there enough staff? Do they have the right skills and 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?

### *Factors/Evidence*

It is very useful for students to research how leading manufacturing companies run their production lines as cost effectively as possible.

Production capabilities, units/hour/week/year.

### *Types of Companies*

See above.

### *Generic examples of questions for companies*

- How do you decide what materials to use?  
What about cost and source?
- Would you source materials from more than one provider?
- How do you check the quality of the material provided?
- How much stock of materials do you keep in reserve?
- Do the materials used degrade in storage?  
How do you stop this?
- How are the materials delivered to you?  
Do they present a hazard on delivery?  
How is this managed?
- What health, safety and hygiene requirements do you have to consider?
- Do you have problems getting the staff you require in this area?
- How do you decide what technology to use?
- What are the quality standards generally demanded by the customers?

# Unit 1

## QUALITY STANDARDS

### *Explanation of Term*

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.

### *Factors/Evidence*

Highlighted quality standards demanded in the brief and answered in the product specification.

Output figures as graphs or charts.

Statistics for achievement of tolerance, % of failures etc.

Sample of packaging.

### *Types of Companies*

See above

### *Generic examples of questions for companies*

- What production rates do you need to achieve?
- What are the main quality standards that the companies you deal with put into place? How well do you achieve these standards?
- How do you ensure your designs meet quality standards?
- What tests are carried out to ensure quality standards are met?
- What do you do with 'rejected' products?
- How are finished products packaged to avoid damage or degradation of quality?
- Do finished products offer any health and safety hazards?

# Unit 1

## DEVELOPING DESIGN IDEAS AND MODIFYING DESIGN SOLUTIONS

### *Explanation of Term*

Developing design ideas and modifying design solutions. Students need to understand how initial ideas go forward into manufacture and still ensure it meets the client design brief.

Students need to understand the following techniques:

- 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.

Any ICT applications to model and test design ideas and solutions are useful as are the restrictions you have come across on using certain materials and methods for certain manufacturing designs.

Students must understand 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.

Students need to understand that it is normal to modify design solutions after consultation with the client.

### *Factors/Evidence*

Detailed design specifications and the associated documents that accompany the development of the specification.

### *Types of Companies*

See above.

### *Generic examples of questions for companies*

- Have you employees who specialise in research? What qualifications do they have?
- What sort of presentation techniques do you use?
- Is there a special person who makes the contact with clients?
- How do you gear up the organisation for modifications to design solutions?
- Typically how long does it take to develop a design idea ready for implementation?
- How are ideas 'tested'?

# Unit 2

## Manufactured Products

This Manufacturing Unit introduces the student to six main themes:

- PRODUCTION PLANS AND SCHEDULES FOR MANUFACTURING.
- TEAMWORK.
- PREPARING MATERIALS, COMPONENTS, INGREDIENTS, TOOLS, EQUIPMENT AND MACHINERY.
- PROCESSING MATERIALS AND COMPONENTS COMBINING, ASSEMBLING AND FINISHING MATERIALS AND COMPONENTS/ INGREDIENTS.
- APPLYING QUALITY AND PRODUCTION CONTROL TECHNIQUES DURING MANUFACTURE.
- HEALTH, SAFETY AND HYGIENE.

## **MANUFACTURING: PRODUCTION PLANS AND SCHEDULES FOR MANUFACTURE/TEAMWORK.**

### *Explanation of Term*

Production plans provide information about the type and quantity of product to be manufactured.

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

### *Factor /Evidence*

It would be very useful for the student to see a production plan and to receive a detailed explanation of how it was put into practice in your company.

Emphasise any teamwork involved. Roles, responsibilities – job descriptions.

### *Types of Companies*

- Food manufacturers
- Clothes manufacturers
- Car manufacturers
- White goods' manufacturers
- All other types of manufacturers

# Unit 2

## *Generic examples of questions for companies*

- Who, in the company, is involved in putting together production plans and schedules for manufacture? What is their job description?
- What factors have to be taken into account when deciding the sequence and timing of stages?
- How do you decide on the critical quality control points?
- How do you decide on the allocation of roles and responsibilities?
- How do you encourage teamwork in your company?
- How long does it take to 'set up' a new production run?
- How is a new product run evaluated?

## **PREPARING MATERIALS, COMPONENTS, INGREDIENTS, TOOLS, EQUIPMENT AND MACHINERY**

### *Explanation of Term*

The student needs to understand that some manufacturing components have to be made or modified 'in house' and others are purchased already manufactured and ready for inclusion in the product. Students need to understand trimming, cleaning, degreasing, preparing blanks and initial processing such as annealing or freezing.

Students need to understand the selection, preparation and usage of tools, equipment and machinery.

### *Factors/Evidence*

The student would benefit from seeing the manufacturing process from start to finish with explanation at the appropriate points about the information spelt out above.

Job roles of 'engineers' as tool makers.

Specifications for 'in-house' modification of tools etc.

Maintenance schedules.

Job descriptions of maintenance engineers.

### *Types of Companies*

See above

# Unit 2

## *Generic examples of questions for companies*

- Why do you make some of the components and buy in others already made up?
- How do you ensure optimum use of materials?
- Why is the process of trimming, cleaning, degreasing etc carried out?
- Do you employ engineers to modify components? What experience/ qualifications do they need?
- Have you enough engineers? Are there skill shortages in the area?
- What kind of equipment do you use e.g. mechanical, pneumatic, electrical electronic?
- What health and safety precautions have to be taken when cleaning equipment?

## **PROCESSING MATERIALS AND COMPONENTS. COMBINING, ASSEMBLING AND FINISHING MATERIALS AND COMPONENTS/INGREDIENTS.**

### *Explanation of Term*

Students must learn how to use appropriate tools, equipment, (including CAM), and machinery safely and use manufacturers instructions.

They need 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.

Students would benefit from seeing how the company combines, assembles and finishes materials, components and ingredients to a production plan and schedule for manufacture in order to meet client requirements and conform to quality standards.

### *Factors/Evidence*

It is useful for the student to see the above processes in a manufacturing environment.

# Unit 2

## *Types of Companies*

Instructions manuals or technical specifications showing set up figures.

Equipment diagrams showing controls for adjustments.

Charts of levels of materials/resources.

Generic examples of questions for companies

- How is CAM used in your manufacturing process?
- Why do you use the tools and equipment you do?
- What advantages does CAM offer?
- How often are machines checked and adjusted during a production run?
- How are material/resources levels maintained to avoid halts in production?
- How much assembly is automatic and how much requires human intervention?
- Which machine requires the greater skill to set up?
- What machines are set up/ adjusted electronically?

## **APPLYING QUALITY AND PRODUCTION CONTROL TECHNIQUES DURING MANUFACTURE.**

### *Explanation of Term*

Students need to understand the importance of implementing quality control processes at critical points, ensuring that the data is recorded in appropriate formats – either manually or on computer.

They also need to understand the procedures that are followed when quality standards are not met and the sorts of changes that are made to ensure problems do not arise again.

They need to see how the progress of production is monitored and be able to identify, record and correct any variance from the manufacturing schedule.

### *Factors/Evidence*

It is useful for the student to see the above procedures in a manufacturing environment.

Examples of materials 'taken' for quality control checks.

Examples of failed products.

Data collection sheets used to record quality measurements.

Print outs from any ICT processed quality data such as graphs and charts.

Production figures over a set period.

# Unit 2

## *Types of Companies*

See above.

## *Generic examples of questions for companies*

- At what points during manufacture do you inspect and test products or components?
- How do you test? What type of measurements are taken?
- How do you record the results of your testing?
- What happens when problems arise – can you go through an actual example?
- What happens when either you are not meeting deadlines or the dates change for delivery?
- What type of tests can be undertaken at the machine? What type must be undertaken elsewhere?
- Has the company a dedicated test laboratory or area. What equipment is in there? What employees are dedicated to this area? What are their qualifications?
- How much of the production is monitored automatically and processed in a central area?

## **HEALTH, SAFETY AND HYGIENE**

### *Explanation of Term*

The student needs to witness as much of the following as possible:

- Carrying out a risk assessment
- Care of the manufacturing environment
- Following safety procedures and instructions
- Keeping a safe place of work
- Checking safety equipment, health and safety and hygiene procedures and systems are operational
- Using safety equipment and health, safety and hygiene procedures and systems correctly during combining assembly and finishing.

### *Factors/Evidence*

Risk assessments as documents.

Documents showing actions from a risk assessor such as applicator of COSHH regulations.

Schedules for cleaning and checking safety.

Copies of safety procedures.

Extracts from the accident book – with personal information removed.

Sample safety equipment – goggles, ear plugs, gloves.

# Unit 2

## *Types of Companies*

All manufacturing environments.

## *Generic examples of questions for companies*

- What sorts of things do you consider in a risk assessment?
- What actions result from a risk assessment?
- What are the most important safety procedures you have to follow?
- How do you train your employees to be aware of health and safety?
- What happens if there is a breach of health and safety?
- What happens if there is an accident?
- How is the manufacturing procedure kept operational? What safety guards and stop buttons do you have?
- Is there any safety clothing that needs to be worn?
- What range of hazards are there in the company?