

**Portfolio marking guidance**

**Edexcel General Certificate of Secondary  
Education in Manufacturing (Double Award)**

June 2003

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# Introduction

## GCSEs in vocational subjects

A range of GCSE (Double Award) specifications in vocational subjects has been introduced to replace and extend the range of Part One GNVQ courses at levels 1 and 2 of the National Framework of Qualifications. They can be taken as two-year courses from September 2002 and one-year courses from September 2003 for first awarding in summer 2004. This document has been prepared specifically to deal with the Edexcel GCSE in Manufacturing (Double Award).

## Edexcel GCSE in Manufacturing (Double Award)

The Edexcel GCSE in Manufacturing (Double Award) has been designed to provide a broad educational basis for further training, further education or for moving into employment within the manufacturing industry. The QCA Qualification Accreditation Number for this title is 100/2064/0.

## Portfolio marking guidance

This guide is designed to give guidance on how to apply the mark scheme, and to enable teachers of the Edexcel GCSE in Manufacturing (Double Award) to form an impression of the kind of work that may be produced as the specification is applied. Each example of work is of a style and a standard as near as possible to the requirements of the new GCSE.

The examples have been extracted from courses with similar content, and analysed to give an indication of how they relate to the levels of response in the mark scheme. Examples of the standard of work felt to contain qualities indicative of the medium level mark band are provided. Examples are not intended to be used as examples of good practice.

This publication is designed for general guidance. Full details of the course requirements can be found in the specification, guidance on internal assessment and the assessment criteria. These publications should be referred to for more definitive information. The teachers' guide will also provide more detailed guidance on dealing with assessment criteria and planning teaching programmes.

## Applying the mark bands

Portfolios will be marked by the centre, and externally moderated by Edexcel. Each of the internally assessed units has a marking grid, divided into three broad mark bands, showing how to award marks in relation to the task and the assessment objectives. The marking grids indicate the required assessment outcomes as well as the quality of the outcomes needed for achievement in each of the mark bands. Mark band 1 relates to the expectations given in the grade description for grade F; mark band 2 relates to the expectations for grade C, and mark band 3 relates to the expectations for grade A. For further information on grading, see the section *Grading and aggregation* which follows this section.

In general terms, progression across the bands is characterised by:

- increasing breadth and depth of understanding
- increasing coherence, evaluation and analysis
- increasing independence and originality.

The unit marking grid shows the allocation of marks by assessment criterion and by mark band. This grid should be used to determine marks for student achievement in each unit. Students can achieve marks in different bands for each assessment objective. The total mark achieved will depend on the extent to which the student has met the assessment criteria overall.

Within each assessment criterion, it is a general principle that shortcomings in some aspects of the assessment requirements may be balanced by better performance in others. However, it is also important to note that for full marks in any particular assessment criterion, all the requirements should have been met.

Marks should not be awarded on the basis of a ‘tick list’ of factual content but on the overall response as it relates to the requirements stated within each mark band. Assessors should adopt a holistic approach and apply their professional judgement. In the specification, the *Guidance for teachers* section in each unit gives specific details of how marks should be allocated.

There should be no reluctance to use the full mark range and if warranted assessors should award maximum marks. Students’ responses should be considered positively. A mark of 0 should only be awarded where the student’s work does not meet any of the required criteria.

The grade descriptions for the Edexcel GCSE in Manufacturing (Double Award) refer to the levels of support and guidance required by students in carrying out investigations and tasks. All students are entitled to initial guidance in planning their work. When marking the work, assessors should apply the following guidelines:

- **‘Some support and guidance’**: the student has to be guided and advised throughout to ensure that progress is made. The student relies on the support of the teacher, who has to assist in most aspects of the work. This level of support restricts the student’s mark to band 1, irrespective of the quality of the outcomes.
- **‘Limited assistance’**: the teacher supports the student initially in the choice of topic for investigation. Thereafter the teacher reacts to questions from the student and suggests a range of ideas that the student acts upon. The student frequently checks matters of detail. The teacher needs to assist in some aspects of the work. This level of support restricts the student’s mark to bands 1 or 2, irrespective of the quality of the outcomes.
- **‘Independently’**: the teacher supports the student initially in the choice of topic for the investigation or task. Thereafter the teacher occasionally assists the student, and only when asked, but monitors progress throughout. This level of support gives access to all three mark bands.

For internal record-keeping purposes, centres may wish to make a copy of the marking grid for each student and use it to record the mark for that unit. The GCSE, GCE, GNVQ Code of Practice requires assessors to show clearly how credit has been assigned. Guidance on how this may be done will be included in the separate support material that will accompany this guide.

## Grading and aggregation

The mark bands used for internal assessment do not relate to pre-determined grade boundaries. Following each examination and moderation series Edexcel will set the grade boundaries for the two internally-assessed units and the externally-assessed unit at an awarding meeting.

The raw mark boundaries will be converted to uniform marks on a scale of 0-100. The final grade for the qualification will be determined by aggregating the uniform marks for the three units. The following table gives details of the uniform mark scales (UMS) used for the units and for the qualifications.

### Unit results

The minimum uniform marks required for each grade:

Unit grade	<b>A*</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>
Maximum uniform mark = 100	<b>90</b>	<b>80</b>	<b>70</b>	<b>60</b>	<b>50</b>	<b>40</b>	<b>30</b>	<b>20</b>

Candidates who do not achieve the standard required for a grade G will receive a uniform mark in the range 0-19 and be recorded as U (unclassified).

### Qualification results

The minimum uniform marks required for each grade:

Qualification grade	<b>A*A*</b>	<b>AA</b>	<b>BB</b>	<b>CC</b>	<b>DD</b>	<b>EE</b>	<b>FF</b>	<b>GG</b>
Maximum uniform mark = 300	<b>270</b>	<b>240</b>	<b>210</b>	<b>180</b>	<b>150</b>	<b>120</b>	<b>90</b>	<b>60</b>

Candidates who do not achieve the standard required for a grade GG will receive a uniform mark in the range 0-59 and be recorded as U (unclassified).





# Exemplars and commentary

This section contains extracts from various candidates' work for the two portfolio units, 1 and 2. All criteria have been separately addressed and the examples of work shown are felt to contain qualities indicative of the medium mark band. The work shown has been extracted from different candidates' projects.

Moderator's comments to illustrate the way in which the coursework has been assessed have been included for each criterion together with an explanation of what is required for the candidate to achieve a mark at a higher level.

## Unit 1: Designing Products for Manufacture

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

- a an analysis of the client design brief and information about key features

### The Design Brief

Autobitz, a national chain of auto-factors, are looking for a product that they can use as a promotional 'give-away' item when they open a new branch. The new branch is opening in late autumn, early winter, so a product suitable for this time of year would be most appropriate.

Initial market research has shown that most drivers would appreciate a compact scraper for clearing ice and snow from windscreens, windows and headlights.

### SIMON'S WORK

#### Initial Design Specification

The ice scraper needs to be strong and not effected by the cold. It needs to be bright and easy to use. The shape must be specially made to suit the surfaces being cleaned.

- Small
- Light
- Easy to use
- It needs to be relatively cheap and there needs to be a lot, because of it being a 'freebee'.
- Needs to be functional.

Also to be taken into consideration is the standards of quality in the product. With a product such as this it has to be safe for the user. It needs to be made to the best quality and designed to the best quality to make it safe and useful.

So the product has to have the following quality measurements:

- All non essential edges and corners should be rounded for safety
- All edges and blades must be safe to the user but still efficient
- No breakable parts that could be choked on or stood on.

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

- a an analysis of the client design brief and information about key features

#### ASSESSOR'S MARKING GRID

	<b>Mark band 1 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 2 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 3 At this level work must show:</b>	<b>Mark range</b>	<b>Mark awarded</b>
<b>(a) AO1 AO2 6 marks</b>	<ul style="list-style-type: none"> <li>an analysis of the brief to identify basic client needs and most of the key features of the product</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>an analysis of the brief to describe the main client needs and the main key features of the product</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>an analysis of the brief to explain the main client needs and the main key features of the product</li> </ul>	5 – 6	<b>4</b>

#### MODERATOR COMMENTS

Simon has provided an analysis of the main client needs and main key features of the product. Some of the needs and features are listed, but some of them are described in some detail. Simon should be awarded 4 marks.

In order for Simon to meet the requirements of mark band 3, he would need to provide more detailed explanations of the main client needs and the main key features.

Many of the client needs have been listed which would meet mark band 1, and Simon has described some of the needs. However to meet mark band 3, Simon would need to explain these needs in some detail. For example, he could have quantified how small and how light the scraper needed to be to suit the client's needs. He could also have suggested that a bright colour would aid recognition in poor lighting. Simon recognised that the scraper needed to be functional. However he could have explained this in more detail. For example, the scraper should be able to clear more than one surface ie screens and headlights. The scraper would also need to be comfortable to handle and not transfer heat rapidly from the users hands (feeling cold to the touch).

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

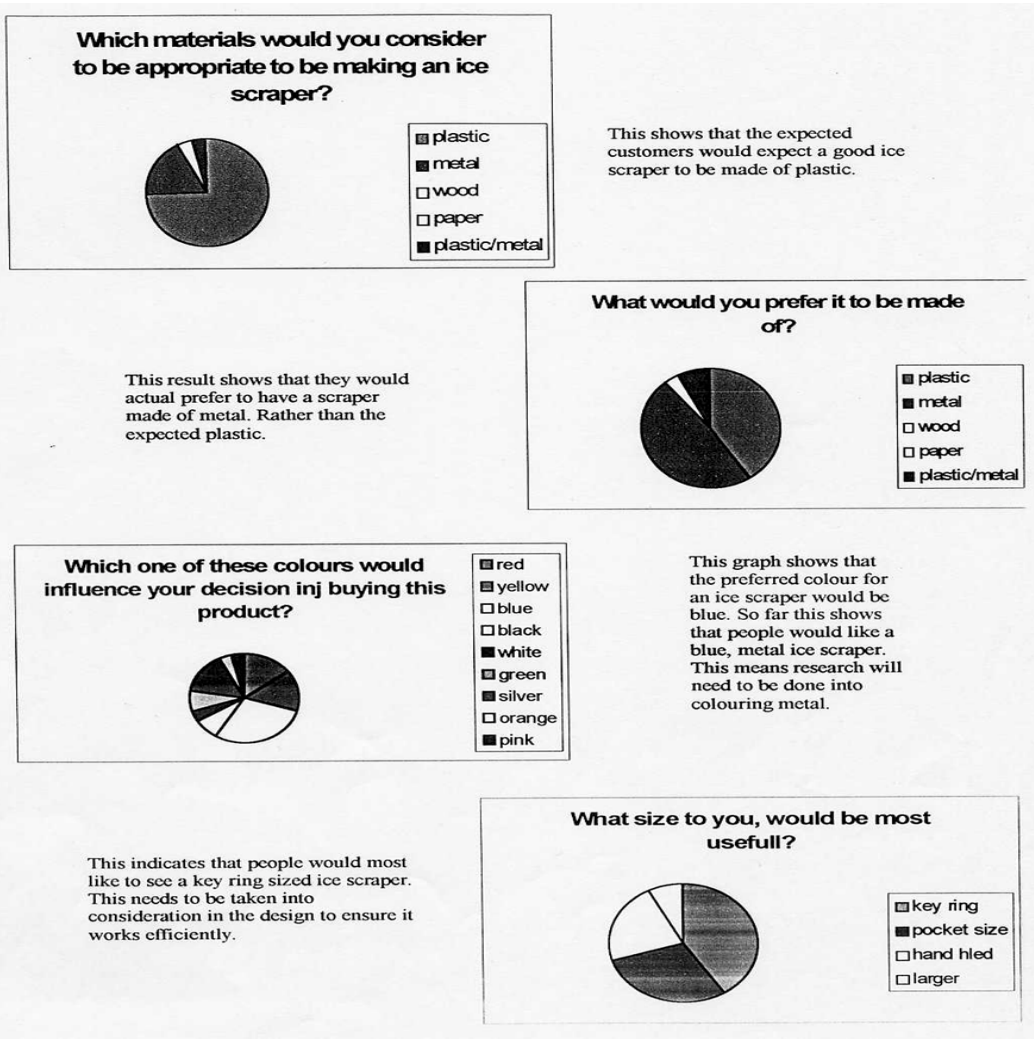
- b details of the product design and material constraints
- c details of production requirements and quality standards

### The Design Brief

Autobitz, a national chain of auto-factors, are looking for a product that they can use as a promotional 'give-away' item when they open a new branch. The new branch is opening in late autumn, early winter, so a product suitable for this time of year would be most appropriate.

Initial market research has shown that most drivers would appreciate a compact scraper for clearing ice and snow from windscreens, windows and headlights.

### SIMON'S WORK



## Materials Research

### Plastics

Most ice scrapers and similar products are made from plastic. This is because it is cheap, light and isn't effected by the elements. Plastic is easy to shape and can be produced in large quantities.

### ABS

Acrylonitrile butadiene styrene plastic has a high impact strength and toughness. It is scratch proof, light and durable. It has a good surface finish and is resistant to chemicals. Such a plastic is often used in the kitchen in kitchenware, toys, safety helmets and other consumer goods. It is also used in car components, telephones and food machinery. This makes it a very good plastic for use with an ice scraper because it is resistant to water and other chemicals found outside.

### Nylon

Polyamide is a creamy coloured, tough and hard plastic. It is resistant to extreme temperatures and is resistant to water. It has a good chemical resistance and machines well. One problem is it is difficult to join. Such a plastic is usually used in bearings, gear wheels, casings for power tools, combs, stockings and hinges. This means it is a good plastic for an ice scraper because it can handle the temperatures and is resistant to water. It is also easy to machine which is an advantage.

### Production

These two plastics leave one production option open. This is injection moulding. This is a manufacturing process that concerns heating the plastic and then injecting it under pressure into a mould. The material is heated to a plastic state. It's then injected under pressure into an enclosed mould. The mould is then opened up and the product removed. Injection moulded products are of a high quality and usually require no further finishing. The machine is made up of an injection unit and a mould. Plastic granules are fed into the mechanism through a hopper and then moved through the mechanism where it is heated and forced into a mould.

### Metals

Because the product survey insisted the public would prefer to have a metal scraper, the scraper would definitely be made of it. This eliminates all other materials like plastic and wood. Also because the product needs to be coloured (blue) it needs to be suitable for treatment eg Anodising. The two main metals for this job would be Aluminium and steel. But because steel can't be anodised or coloured easily and cheaply, the aluminium is the perfect choice.

### Aluminium

Aluminium is a lightweight, silvery metal. It melts at 660° C and boils at 2467° C. Aluminium is a strongly electropositive metal and extremely reactive. In contact with air, aluminium rapidly becomes covered with a tough, transparent layer of aluminium oxide that resists further corrosive action. For this reason, materials made of aluminium do not tarnish or rust. Aluminium is the most abundant metallic constituent in the crust of the earth; only the non-metals oxygen and silicon are more abundant. Aluminium is found commonly as aluminium silicate or as a silicate of aluminium mixed with other metals such as sodium, potassium, iron, calcium, and magnesium, but never as a free metal. A given volume of aluminium weighs less than one-third as much as the same volume of steel. The only lighter metals are lithium, beryllium, and magnesium. Its high strength-to-weight ratio makes aluminium useful in the construction of aircraft, railway carriages, and motor vehicles, and for other applications in which mobility and energy conservation are important. Because of its high heat conductivity, aluminium is used in cooking utensils and the pistons of internal-combustion engines.

The metal is becoming increasingly important architecturally, for both structural and ornamental purposes. The metal is also used as a material in low-temperature nuclear reactors because it absorbs relatively few neutrons. Aluminium becomes stronger and retains its toughness as it gets colder and is therefore used at cryogenic temperatures. Aluminium's resistance to corrosion in salt water also makes it useful in boat hulls and various aquatic devices. A wide variety of coating alloys and wrought alloys can be prepared that give the metal greater strength, or resistance to corrosion or high temperatures.

### **Production**

Punching is a relatively simple process. It is normally done on CNC machines and requires programmes. These programmes highlight the dimensions and tools required making the part. In this case it is the metal credit card sized strip. The machine will feed metal sheets or strips through the main body of the machine. As it passes through the machine a punch that is the same shape as the required card will crash down onto the strip. This block of steel will be a prism version of the card. It will be a cast block that is used to punch through the metal. Underneath the metal sheet is another tool. This is called a dye. The dye is a plate that has a shape cut out of it.

The shape is the same as that of the required part. So if the punch and the dye were put together, the punch could fit through the dye perfectly. This means when the punch smashes through the strip the strip is forced through the dye and into a storage compartment. These two tools ensure the punched card is the right size. They are very accurate and quick. This means metal can be fed through the machine at great speed and the punch and dye can make many parts in a short amount of time.

The cast and dye method will produce a shape of metal with serrated teeth. Another punch needs to be used to chamfer those teeth and make the side blades sharp. This punch is used like a stamp. Instead of having two pieces to the punch, this tool has one. On the dye are the shape of the logo and the shape of the serrated teeth and blades. This will make the teeth and blades sharp and a logo will be stamped into the top of the piece. This fast moving dye will stamp the pattern into the surface of the metal, similar to a branding effect.

### **Anodising**

Anodising most closely resembles standard electroplating. When a reactive metal is suspended in an electrolytic bath as an anode (+) and current is passed through the bath, oxygen is produced at the anode surface. This oxygen reacts with the metal to form a thin oxygen film that generates colours. The transparent oxide will grow to a specific thickness/colour and stop. Having reached a stage where current will no longer pass. This phenomenon of voltage controlled growth means that the colour is also voltage controlled. While oxygen is produced at the anode (+), hydrogen is formed at the cathode (-). Titanium and steel make most convenient cathodes. After researching into Anodising and the process it involves. Originally stainless steel was the ideal metal, but because you can't anodise stainless steel the new choice for a metal will be aluminium. The research I have conducted has lead me to believe for a credit-sized piece of metal, to be anodised in a blue colour, it would cost roughly £1.50. That works out roughly just under 90p.

## Legislation: Health and Safety

This section is an explanation of a contracted manufacturing company's legal responsibilities for Health & Safety for employees, customers and other people who may be on site.

### The health and safety at work act (1974)

This requires a written policy statement to be produced by the company and to be signed by the managing director/chairmen level personnel, together with the necessary management system.

*As an update to the 1974 act the six directives came into force in 1993.*

It is made up of six regulations:

1. Management of health and safety at work regulations 1992- requires that employers assess risks to health and safety to employees and other persons who may be on site (visitors). Providing adequate information/training so employees understand risks/safety.
2. Provision and the use of Work Equipment Regulations 1992- requires that all equipment used within the companies is suitable for the job and that staffs are appropriately protected when using the machinery. Means there is a need for assessing the risks and putting in place necessary precautions.
3. Manual handling operations regulations 1992- requires that employees are trained in the handling of loads (including loads that need mechanical assistance).
4. Work place (health, safety and welfare) Regulations 1992- requires that employees are in an adequate working environment (temperature/ lighting/ventilation) and in a safe place of work (proper toilet, drinking water/storage facilities etc).
5. Personal protective Equipment at work (PPE) Regulations 1992- must have suitable, properly maintained, used and stored. Employers should be trained in its care and maintainability.
6. Health and safety (Display Screen Equipment). The workstation the employer uses must be at the minimum ergonomic standard. Staff must have regular breaks and have adequate training. The staff is entitled to eyesight tests at their employer's expense.

### Disposal of waste products

The waste products left at the end of this production will be metal scraps. These can be collected and taken away. After it will be melted down and recycled. This is in compliance with ISO 14001 environmental standards. Where a contracted disposal body will collect the recyclable material waste, thus reducing potential pollution and damage to the environment.

### Final Design Specification

The ice scraper needs to be strong and not effected by the cold. It needs to be bright and easy to use. The shape must be specially made to suit the surfaces being cleaned.

- Small
- Light
- Easy to use
- It needs to be relatively cheap and there needs to be a lot, because of it being a 'freebee'.
- Needs to be functional.

Also to be taken into consideration is the standards of quality in the product. With a product such as this it has to be safe for the user. It needs to be made to the best quality and designed to the best quality to make it safe and useful.

So the product has to have the following quality measurements:

- All non-essential edges and corners should be rounded for safety.
- All edges and blades must be safe to the user but still efficient.
- No breakable parts that could be choked on or stood on.

After the market research I have made amendments and additions to the initial specification.

- The scraper needs to be the same width and length as a credit card. (55 mm X 85 mm).
- There needs to be a set of chamfered serrated teeth and a pair of curved blades on the design.
- There needs to be colour in the design.
- My survey shows that it needs to be made from metal. I will use aluminium.
- Key ring sized is another option.
- It should cost between 50p and £1.25.



**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

- b details of the product design and material constraints
- c details of production requirements and quality standards

**ASSESSOR’S MARKING GRID**

	<b>Mark band 1 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 2 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 3 At this level work must show:</b>	<b>Mark range</b>	<b>Mark awarded</b>
<b>(b) AO1 AO2 6 marks</b>	<ul style="list-style-type: none"> <li>• a design specification that identifies basic details of the product design, the materials chosen and some constraints</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>• a design specification that describes some of the details of the product design, the materials chosen and the constraints</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>• a design specification that explains the main details of the product design, justifies the materials chosen and evaluates the constraints</li> </ul>	5 – 6	<b>4</b>

**MODERATOR COMMENTS**

Simon has produced a good design specification that describes the main details and his research describes some of the significant material constraints. It is not clear that he has used a range of sources of information, although there is evidence to suggest that he has carried out some research related to users. Simon would be awarded 4 marks.

Simon has attempted to explain the reasoning for some of the main details. This reasoning would require more depth in order to attract a higher mark. His research has identified reasons for choice of suitable materials and his school survey suggested that most would prefer the scraper to be made from metal rather than plastic. However, he has not justified his choice of aluminium as a suitable material.

<b>(c) AO2 AO1 AO2 6 marks</b>	<ul style="list-style-type: none"> <li>• a design specification that identifies basic details of production requirements and quality standards</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>• a design specification that describes some of the details of production requirements and quality standards</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>• a design specification that explains the main details of production requirements and quality standards</li> </ul>	5 – 6	<b>4</b>
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**MODERATOR COMMENTS**

Simon has carried out some research and has listed some of the main production requirements for each of the materials chosen. There are no specific quality standards identified but Simon has included a study of the main Health and Safety requirements and has considered some essential quality requirements of the product. Simon should be awarded 4 marks.

In order to meet the requirements of mark band 3, Simon could have detailed quality standards such as dimensional and geometric accuracy and surface finish. These quality standards would affect the choice of production equipment needed to ensure manufacturing consistency.

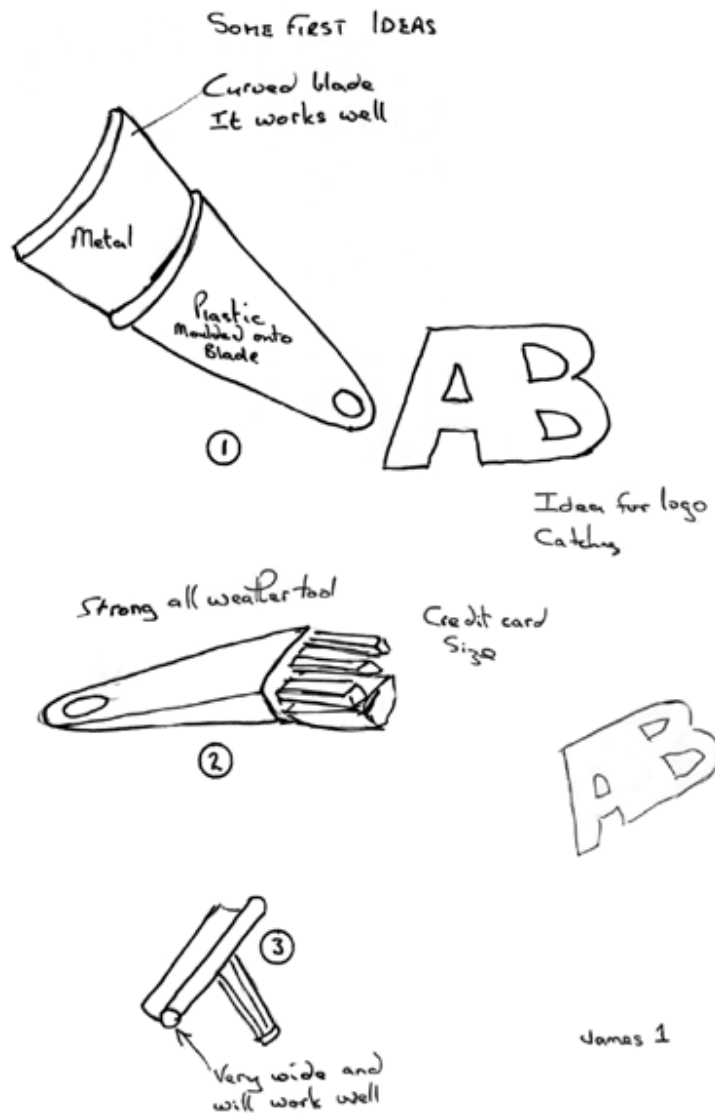
You need to produce a product design specification and design solution for a manufactured product from a given brief including:

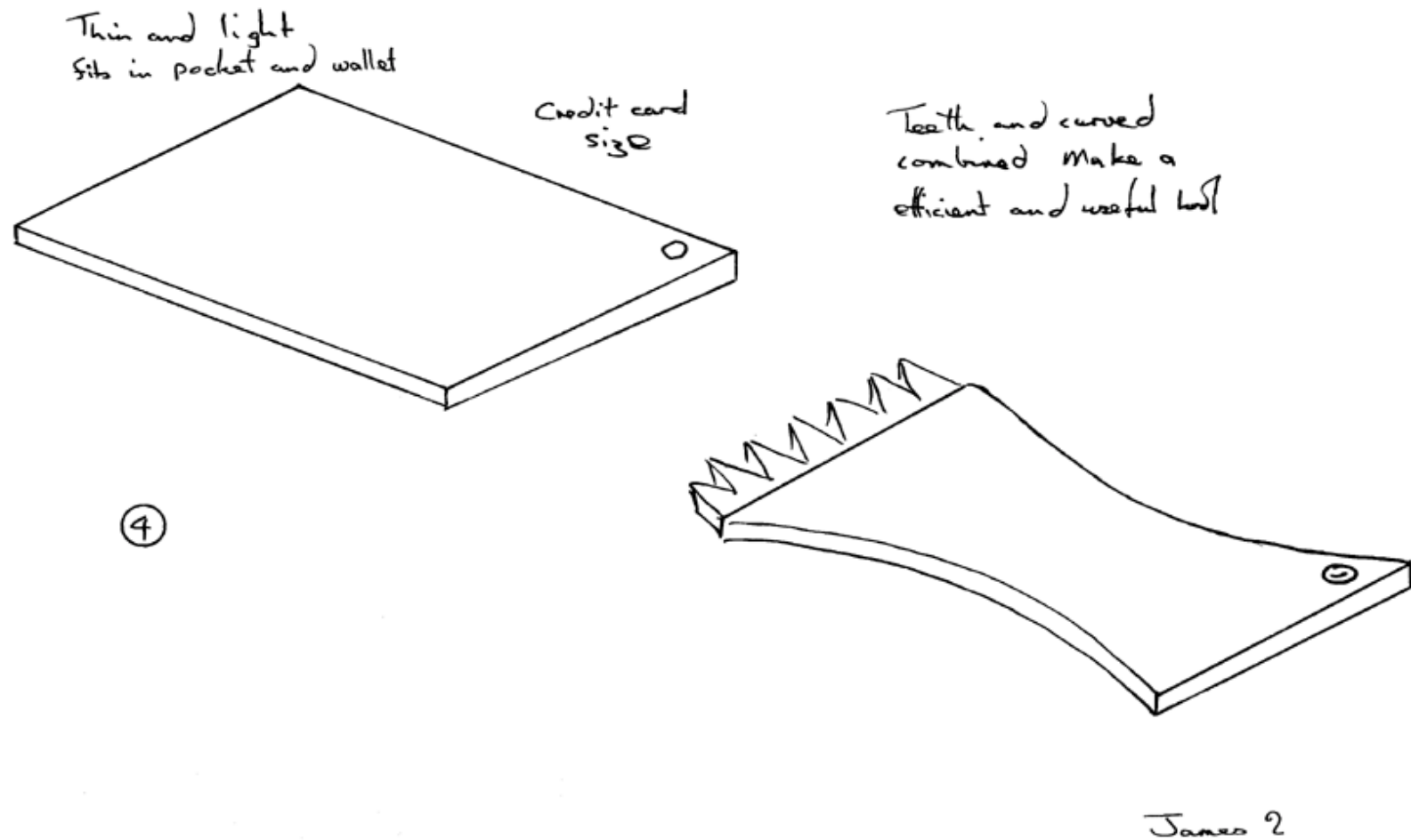
d a range of design ideas and evidence of testing them

## JAMES' WORK

### Designs

The initial ideas are the starting points of the design. I put rough sketches and ideas on paper. Just to get an idea of what I'm looking for. The sketches here concern many factors. Shape of the product, the size, the type of blade and scrapers that make it work. Looks and aesthetics are also important.





**Selecting the initial idea for further work**

I think that each of the ideas would work as an ice scraper.

## Production methods

Idea 1 would require two separate manufacturing methods.

The blade would be punched and then the handle would be made of plastic and moulded onto the blade.

Idea 2 would have different scraping blades all made separately and then moulded into a plastic handle.

Idea 3 would be made of injection moulded plastic.

Ideas 1, 2, and 3 would all cost more to make since they would need more production processes.

Idea 4 would be made from aluminium and could be punched from one piece.

Design Feature	Idea 1	Idea 2	Idea 3	Idea 4
Processing	Two part different processes	Two part different processes	Two part different processes	One process
Size (Will it fit in pocket)	Yes	Yes	No – it might but it would stick in you	Yes it would fit in a wallet or on a key ring
Is it attractive	Yes	No	No	Yes
Ease of operation	If it is small it will be difficult to use	If it is small it will be difficult to use	Would work well	Would work and would have two different edges.
Function				
Cost	Medium	High	Medium	Low
Breakable Parts	Blade could break from handle	Blades could break from handle	If small – handle might break	No

I have decided to develop Idea 4, because it best meets the design brief, and I think that it would be an attractive 'freebee'. It would be easy to make, cheap to make, fit in your pocket or wallet and work well.

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

d a range of design ideas and evidence of testing them

#### ASSESSOR'S MARKING GRID

	<b>Mark band 1 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 2 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 3 At this level work must show:</b>	<b>Mark range</b>	<b>Mark awarded</b>
<b>(d) AO2 AO3  6 marks</b>	<ul style="list-style-type: none"> <li>the generation of basic design ideas and limited testing of ideas</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>the generation of alternative design ideas and a range of testing of ideas</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>the generation of imaginative design ideas and objective testing of ideas</li> </ul>	5 – 6	<b>4</b>

#### MODERATOR COMMENTS

James has produced a range of different outline ideas, some of which are very similar to market leading products. However some of the ideas are imaginative. His sketches lack detail, but he has demonstrated an understanding of production, materials and cost in his analysis of the merits of different ideas.

James should be awarded 4 marks.

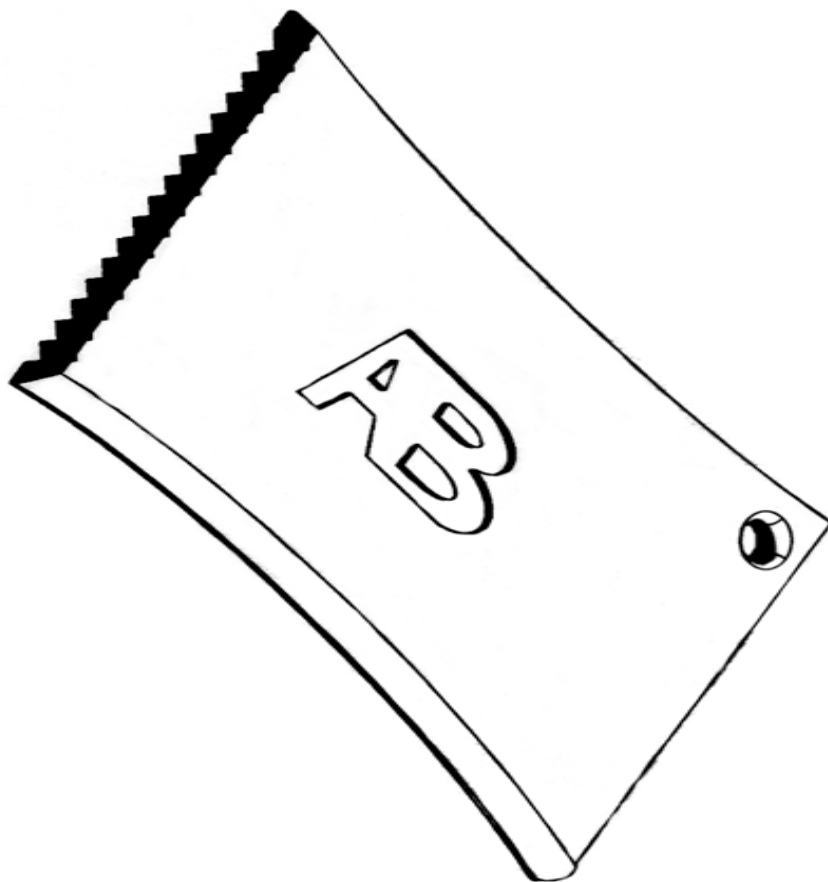
In order to meet the requirements of mark band 3, James would need to generate the outline ideas in greater depth. His outline solutions do not include sufficient information relating to how the products might be made and also features that would be necessary to make them viable. Some of his solutions required moulding of scraping edges into the handle. In order to achieve this, it would be necessary to identify design features such as the size and shape of the required shanks.

James' testing of his ideas lacks sufficient depth of analysis to meet mark band 3. He has not qualified many of his assumptions. How does he know that any of his designs would function properly? Costs have not been detailed and therefore it is not possible to determine that one design would cost more to manufacture than any other design.

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

- e evidence of how you tested and justified your final solution

### **JAMES' WORK**



**Initial idea need to expand.**

### **First attempt**

When making the first Idea I used pro desktop. To start with I made a thin cuboid. This gave me the base for the card. It had the dimensions of a typical credit card. Just a little thicker. After making this card the right sized dimensions are added. Once these are in place the sizes can't be changed by accident. Now that I had the base shape I could start modifying the edges and side to my design. I needed to make two curved but bladed edges and a serrated edge (Teeth). The first edge that needed to be done was the teeth. For this I created a new work plane on the top face. To do this I highlighted the face and selected new work plane from the right hand mouse button menu.

### **Serrated edge**

Once this was done I made the pattern of a zigzagged line 5mm down from the face I wanted to change. Then by extending the profile through the work piece, I was able to remove the material around it. This made a serrated edge. The next thing to do was make it an angled serrated edge. This is difficult because it requires making another workplane on the side of the part. I did this by highlighting the right hand side face and making it a work plane. On the same end I wanted to make the edge, I made a small right angle triangle on the top line, leading to the bottom line. (Upside down) I then extruded this profile through the work piece to remove all the material above the blade. Now there was a blade edge with serrated teeth.

There was a problem the first time I made this edge. Because of the pattern of the zigzags there was an extra 'half-tooth' at each end. This is a serrated tooth but it isn't complete. Normally it would be tolerable because it didn't restrict the use of the scraper.

With both sides curved and sharpened and the front face serrated, all that was left to do was put a key ring hole in the back and curve all the other edges.

### **Hole**

For the scrapers use it was decided it would be useful to include a key ring hole. This meant that the product would be even more convenient. To do this all I had to do was draw a circle on the same work plane as the curved extrusion. Once the picture is updated, the hole will remove material through the part along with the two sides.

The edges of the hole are then curved to create a smooth edge. This is done with the rounding tool. To use it, the edge must be highlighted and then curved. There is a value to be entered for degree. In this case I used 10 for all curves on the design.

### **Rounding**

All other edges on the design were rounded. This included the back edge, the corners and the hole. Highlighting the edges and selecting the rounding tool did this. Again the value of 10 was entered into the box to give the same gradient of curve all over.

Once the main base shape was finished, it was time to add the logo.

Creating a new work plane on the top of the piece, I drew the logo. I then extruded it into the work piece, but not all of the way. I only extruded and removed material down to a millimetre. This gave me a stamped effect. Now the design was complete. All that was left was to put it into an album to give it texture and colours.

## Album

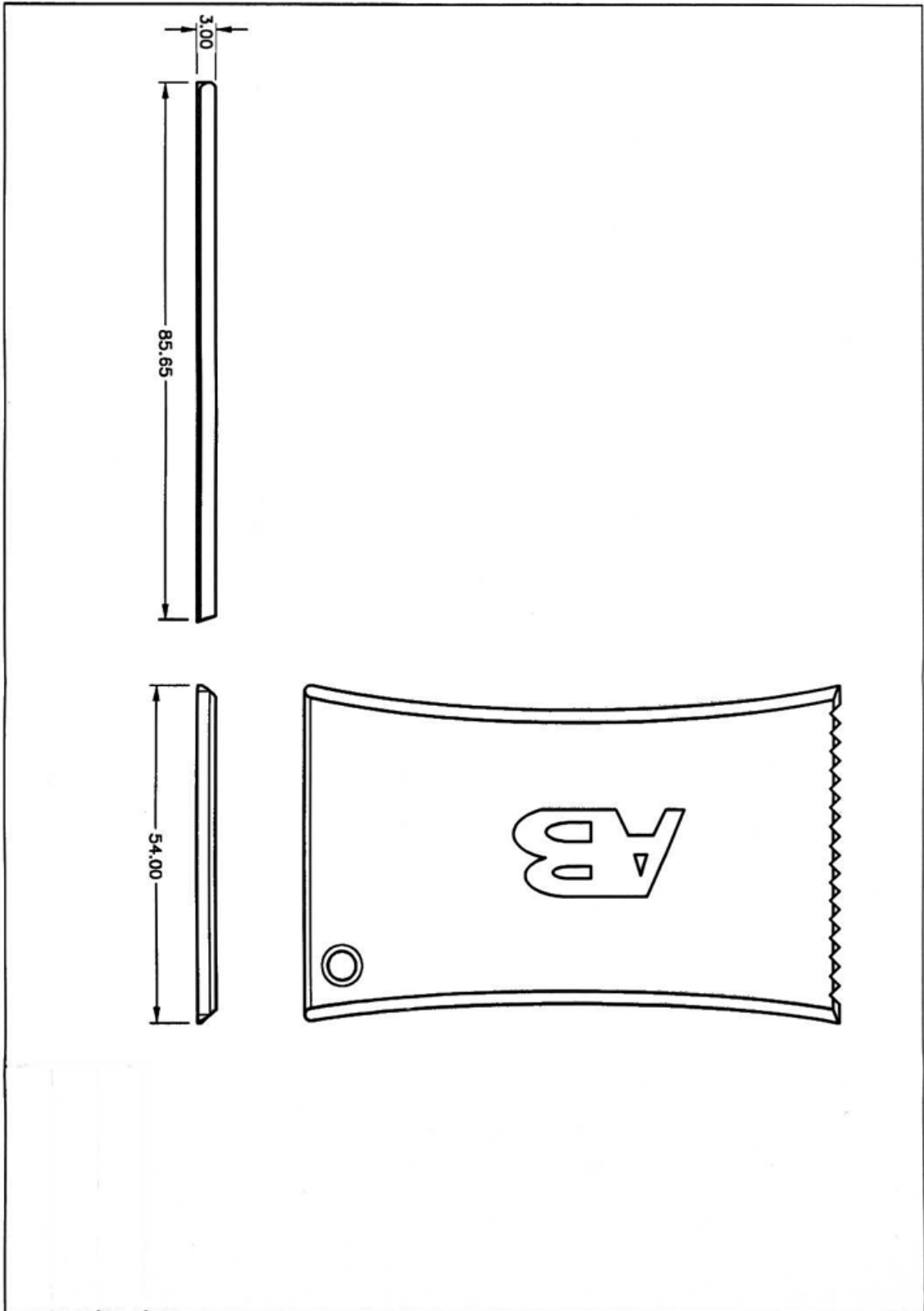
The album is used to give the designs texture and colour. It is easy to use and simple to manage. To add colours simply choose the colour or style from the menu and drag the symbol to the drawing. When the drawing changes to a wire view, releasing the mouse button will give it colour. To see the colour change the update button needs to be used. Then the drawing will fill with colour. The colours can even be textures. This means that you can give the drawing a material. For example I used metal. This gives the drawing a metal look.

One problem I had with this was the logo. The logo wasn't clear at all when the material was added. The shadows gave it a little strength but it needed something else.

So my idea was to take a copy of the logo of the base, the flat area at the bottom of the extrusion. This made a 'plate' of the logo. This was then slid back into the extrusion.

This means that when I put the image back into the album, there would be two things to colour, this meant I could make them different colours and make the logo come out much clearer. In the end I used a rough metal colour for the logo and a marble effect for the scraper. This could be altered to make the scraper blue. The album also allows you to change the lighting, foregrounds and backgrounds. All of these combined lead to a good looking presentation copy of the design.





**Why No. 3**

I chose the third idea because it most followed the specification.

It is easy to make.

It would be cheap to make and therefore a good 'freebee'.

It is lightweight and strong.

It is easy to use and the unique design makes it a very useful tool.

Because of its size it can be stored in the pocket or even a wallet.

It is strong and protected against tarnish and weathering.

The different blades allow it to be used on different types of window and different curve gradients of window.

It can even be joined to a key ring with the nifty hole in the corner.

It follows the brief in that it is compact and that it can be used to remove all ice. Even from lights and windows. Following the market research specs, this design complies in that it is coloured, pocket sized, light and made from metal. It is also an advantage because it is all one piece of material and has no separate parts. As explained earlier in the case study, this product would most likely be manufactured on a punching machine. (see production.) This basically means the scrapers will be punched out of sheet metal or strips of metal using a caste and dye. This is fast and efficient way of manufacturing an item such as this. It is better than hand making the products individually because it saves time and it ensures that all the pieces will be the same. Although handwork can make a fine work piece, it takes a lot of time and nearly every piece will be different. This is a very expensive form of manufacture because of the time it takes and the manpower. Machines are cheaper to run than paying individual workers to work by hand. The cast and dye method will produce a shape of metal with serrated teeth. Another punch needs to be used to chamfer those teeth and make the side blades sharp. This punch is used like a stamp. Instead of having two pieces to the punch, this tool has one. This has the shape of the logo and the shape of the serrated teeth and blades. This will make the teeth and blades sharp and a logo will be stamped into the top of the piece. This fast moving dye will stamp the pattern into surface of the metal, similar to a branding effect.

I made some models of three of the designs and tried them out on some frosted glass. When I made the designs 1 and 2 small enough to fit in my pocket they were difficult to hold and slipped out of my hand when I tried to clear the glass.

Design 3 worked well.

**Final Design**

This design is the ideal size and shape for my specification. Because of its thickness and shape it can be kept in my pocket, on a key ring or even in a wallet. It was keyed to be the same size as a credit card.

The main features of this design are the curved blades and the serrated teeth.

The teeth are not too sharp as to scratch the windscreen of a car. But they are so angled that the user can break through frozen ice on the windscreen. They are not too sharp as to hurt the user if they put it in their pocket.

The curved blades are matched to that of a typical windscreen. They are not too sharp as to scratch the glass, but are sharp enough to shift through ice. There are two of these blades on either side of the piece. They are different gradients of curve to suit different types of windscreen.

Other features of this new design are that it has a small hole at the back to attach to a key ring or chain. This allows for extra storage or something to hang it on.

All sides that were not designed to be used, are rounded off and curved to stop them injuring the user.

This idea came from the knowledge that a lot of people tend to use their own credit card to scrape ice off the car if they have lost or broken their own ice scraper. Using this I devised an ice scraper with as much convenience and has a few extras.

This scraper is also very strong due to it being made of aluminium. So further strengthening it, the metal has been anodised. This makes it a little stronger and also allows for colourful designs and patterns.

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

e evidence of how you tested and justified your final solution

#### ASSESSOR'S MARKING GRID

	<b>Mark band 1 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 2 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 3 At this level work must show:</b>	<b>Mark range</b>	<b>Mark awarded</b>
<b>(e) AO3  6 marks</b>	<ul style="list-style-type: none"> <li>limited testing against the design criteria and an outline of the final design solution</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>a range of testing against the design criteria and a description of the final design solution</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>objective testing against the design criteria and a justification of the final design solution</li> </ul>	5 – 6	<b>4</b>

#### MODERATOR COMMENTS

James has developed a final design solution and explained its key features. The production and material constraints were developed in earlier evidence. He used a range of testing against the design criteria and described how his final solution meets all the main requirements.

James should be awarded 4 marks.

James records that he has tested his other designs and provides some limited evidence of how his chosen design better meets the client brief.

As a free gift, the final design would be quite expensive to make. There would be waste products during the manufacturing processes, which would increase the overall cost. James has evaluated the strengths of his final design. However in order to improve his mark, he would need to provide a greater understanding of the possible weaknesses of his chosen design and compare these with his alternative designs. Possible weaknesses could include: cost, ability to transfer heat (feeling cold when in use), and other features such as rigidity. He does not appear to have considered the possibility of using a plastic credit card blank embellished with a suitable logo. He could have tested the efficiency of the 'credit card' compared with his aluminium model. Objective testing may have indicated that his final design was too complex to meet all of the requirements of the client brief.

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

- f evidence of how you selected and used presentation techniques
- g evidence of how you responded to external feedback and modified your design proposal.

## **JAMES' WORK**

### **My Presentation**

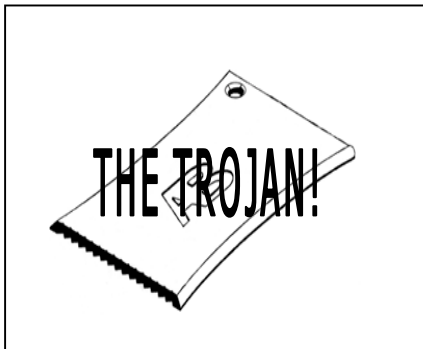
I am going to make a presentation to a group of people from AutoBitz.

I have made a prototype of my scraper because I think that they will want to handle the product. This will give them a clear idea of what it is like and what it can do.

I am also going to make a PowerPoint presentation. This will let me sell my idea to the group.

As well as my main PowerPoint presentation I will have my drawings and sketches in another PowerPoint presentation. This will let me show my ideas clearly and will also allow me to use the CAD sketches and drawings I produced during the development of my solution. This should let me tell them all about the design and how it would be made.

I will give each of the three people a copy of my presentation so that they can take it away and look at it later.



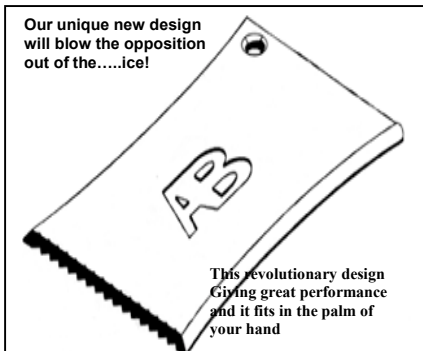
**Auto Bitz....The next big thing in ice scrapers!**

The next big thing in ice scrapers!  
See what you've been missing...  
?

By James

**Old and Out**

Old ice scrapers- out dated and dull.  
Need something more easy to use and easy to carry?  
Want an ice scraper that doesn't only look good but works well?  
Forget that old brick of an ice scraper and look to the future.



**What's new?**

The new sleek design is small enough to fit in your wallet.  
It's strong enough to withstand constant use.  
It clears ice in minutes.  
It can even be held on your key ring.

**Help you....**

No more bulky and awkwardly shaped ice scrapers taking up valuable space in your car.  
Easily carried around and stored.  
Quick and easy to use.  
Easy to clean and maintain.  
Not effected by the cold or weather conditions.

**Specifications**

Market research tells us this product has to be pocket sized and light.  
It has to be metal but colourful.  
This comes to about 90 pence each. Well within market research prices.  
The product is strong and durable.

**Pricing**

Due to metal production methods and anodising treatments the product comes to a rounded 90 pence per scraper.  
This makes the product very cheap and effective piece of kit.  
Ideal for free promo or special event.

**The Trojan!**

See what you're missing

## Presentation

The presentation made a strong case to the customer and I feel it was successful in gaining their interest in the product. It was informative and interesting, still there were some areas that the customer was unclear on and they needed to be cleared up.

Following the presentation I have come across a few minor details that can be ironed out:

- Whereas the key ring hole was always an idea, the interest of the customers in it has made me make it a definite and permanent feature on the ice scraper.
- The keen interest in the safety of the ice scraper has led me to question how safe it really is. All due care has been taken to make sure there are no unnecessary sharp areas or points, so the user isn't harmed. The next step would be to test the product with a small sample of people. People who might use it and test whether it is safe, should any modifications need to be made. This test will indicate the appropriate action to be taken. As it stands the product is sufficiently safe until proved otherwise.
- Even though the customer survey specified a blue coloured design. I'm sure there will be other colours available and there will be scrapers in varied colours should the customer demand arise for them.
- Although I took a lot of trouble to make sure that the half tooth at the end of the serrated blade was a whole tooth, the group asked if I could round off the ends so that it would not tear holes in someone's pocket.

I have changed the design to include an 8mm radius at each end of the serrated edge.

- The client questioned the price of the object, and although I think that 90p is a reasonable price, they asked if it was possible to make the scraper cheaper and still retain its quality.  
I have looked at making it out of ABS plastic and using injection moulding since this should be a lot cheaper to make.

# Witness Statement

Candidate name: *James Morris*

Unit title: *Unit 1 Designing Products for Manufacture*

Candidate number: *4102*

**Activity context:**

Outline of the activity and its purpose. This may be written by the candidate prior to the observation.

*Presentation to a role-play group representing the Client.*

**Assessment evidence:**

Refer to the assessment grids reproduced from the specification.

*(f) evidence of selection and use of presentation techniques*

*(g) evidence of responding to external feedback and modification of design proposal.*

**Observation notes:**

Specific comments on candidate performance that demonstrates achievement of the assessment evidence.

*James gave a confident presentation to a group of four 'role-play' representatives of the client company.*

*After making his main presentation, James was able to respond to questioning and used PowerPoint to present drawings and sketches that he had developed during the design process to explain how the product would be made.*

*Since the presentation James has modified his design and also made a model of the modified design to incorporate suitable radii at the ends of the serrated edge.*

*James has also investigated the feasibility of producing the scraper from ABS and using injection moulding.*

Witness name: *Eric White*

Witness signature: *E WHITE*

Job role: *One of role-play clients (Technician)*

Date: *13/5/0X*

Assessor name: *Mr F Hugh*

Assessor signature: *F HUGH*

Date: *15/5/0X*

**You need to produce a product design specification and design solution for a manufactured product from a given brief including:**

f evidence of how you selected and used presentation techniques  
 g evidence of how you responded to external feedback and modified your design proposal.

<b>ASSESSOR'S MARKING GRID</b>							
	<b>Mark band 1 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 2 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 3 At this level work must show:</b>	<b>Mark range</b>	<b>Mark awarded</b>
<b>(f) AO1 AO2 6 marks</b>	<ul style="list-style-type: none"> <li>• the selection and use of a limited range of techniques to present the final solution</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>• the selection and use of a range of techniques to present, in some detail, the final solution</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>• the selection and use of an appropriate range of techniques to present, in detail, the final solution</li> </ul>	5 – 6	<b>4</b>
<b>MODERATOR COMMENTS</b>							
James used a range of presentation techniques including PowerPoint. James gave brief reasons for his choice of techniques. Much of his prepared presentation was aimed at advertising his product and lacked detail relating to how the product would be made. There is evidence that he had materials available to illustrate the solution in more detail, but he did not fully plan their use. He has included copies of his main slides and the 'Witness Statement' confirms that the presentation was made with some skill and accuracy. James should be awarded 4 marks.							
<b>(g) AO2 AO3 6 marks</b>	<ul style="list-style-type: none"> <li>• limited response to external feedback and the identification of relevant modifications to the design proposal</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>• evaluation of external feedback and a description of relevant modifications to the design proposal</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>• objective evaluation of external feedback and an explanation of relevant modifications to the design proposal</li> </ul>	5 – 6	<b>4</b>
<b>MODERATOR COMMENTS</b>							
James has responded to the feedback from the client. He has considered the manufacture of the product using ABS plastic and had modified the design to provide radii at the corners of the serrated edge. He has not commented on the modifications and has not quantified the effect of these modifications. Therefore James should be awarded 4 marks.							



## Unit 2: Manufactured Products

**You need to produce a quantity of one product, from a given product specification and production plan. The product must be made from at least two components or different materials. You must also compile a portfolio to show how you:**

- a worked as part of an effective team

### EMMA'S WORK

#### Meeting details

On 18<sup>th</sup> December 200X, 9.20 am, our first meeting was held to decide how we were going to make our batch of Macadamia nut brownies.

The team consisted of Woden, Cassandra, and me (Emma).

The first thing we did was try to elect a chairman. This did not work because there were only three of us and nobody wanted the job. So we decided just to look at the information we had been given and sort out what we needed to do.

We were given:

- a recipe for the Macadamia nut brownies,
- a product specification (list of the description of the product, materials, measurements, critical control points, finishing touches and the quality indicators) for the product.
- a production plan

We decided that we would need to:

- Work out the time needed to prepare and do each of the tasks
- Sort out the more important tasks to the work flow
- Schedule the tasks
- And communicate it to the team members.

First we decided to list the strengths and weaknesses of the team. Here are the strengths and weaknesses of everyone in our team.

Name	Strengths	Weaknesses
Woden	Cooking	Computing & Presentation
Cassandra	Designing	Presentation
Emma	Flowcharts	Presentation & Design

We got our notes about production planning and found out about Production Schedules.

A production schedule is the sequencing of operations due to the most cost-effective way within a factory. The most common method for preparing the production schedule is to use a Gantt chart. The Gantt chart identifies the activities necessary to manufacture the product in a form of a diagrammatic form against a time-scale. It is a splendid method for displaying and communicating production schedules as it has the advantages of being easy to read, change and update. There are five points to consider though when producing a schedule:

- Labour availability
- Machine availability
- Delivery date
- Customer
- Costs

The schedule includes:

- Sequence of jobs
- Set up time (Occurs at the beginning of each process and there is no transit time between processes)
- Process time
- Critical control points

We decided that each of us should prepare an idea of the schedule for this job and bring them to the next meeting.

### Evaluation on batch producing chocolate Brownies.

I was in charge of this product as I was the one who carried out the one-off production

We worked to the production schedule so we could work faster and more efficiently, not waste time. We separated and started to do each section independently. I started off by measuring out all the ingredients and then carrying out the batch production plan out one by one. We didn't encounter any problems whilst we were producing our brownies and it turned out to be a very successful production.

In this picture you can see the team members batch producing the chocolate brownie.



Here I am adding the egg to the mixture



Here is a picture of me stirring the brownie mix



### How we worked as a team

The team members were Woden, Cassandra and Emma (me). This time we worked with different team members and it helped me to be a better team player. The first product we did was for one-off production. I found the role of telling the others what to do and making sure they accomplish it is not one of my strengths. In this case everyone was included and roles were identified and stuck to their responsibility. Communication was effective and appreciated. With the help of each other's motivation we got the jobs done sharing and changing jobs when someone looked bored in what they were doing. If a team member thought another team member could do a job better than she/he could then they would share the job with you or give you full responsibility for it.

We would follow through the schedule, checking that we had read the instructions properly, the only down side to the schedule was it did not have the quantity of ingredients for mass production. Instead we had to refer to the main recipe to calculate the amount. There would always be somebody who would monitor what was going on. Good communication and motivation went well as the team members were willing to do a good job.

## Witness Statement

Candidate name: *Emma White*

Unit title: *Unit 2 Manufactured Products*

Candidate number: *1122*

**Activity context:**

Outline of the activity and its purpose. This may be written by the candidate prior to the observation.

*Working as a member of a team to produce a batch of chocolate brownies.*

**Assessment evidence:**

Refer to the assessment grids reproduced from the specification.

*(a) worked as part of an effective team*

**Observation notes:**

Specific comments on candidate performance that demonstrates achievement of the assessment evidence.

*During the coverage of this unit Emma was part of three different teams. This statement relates to her performance whilst making the chocolate brownies. Teamwork was not effective in the early production activities. However this team worked together well.*

*The team set targets for each other and identified these in a basic production schedule and throughout this project individuals and the team met stated targets. The products took a little longer to manufacture than the set deadline, but the team still completed their write-ups in time by doing some extra work.*

*Emma recognised that she was not good at acting as a leader. However during the production activities Emma was able to provide support and assistance to both of the other team members at times.*

Witness name: *Miss E Harp*

Witness signature: *E HARP*

Job role: *Teacher*

Date: *5/10/0X*

Assessor name: *Miss E Harp*

Assessor signature: *E HARP*

Date: *5/10/0X*

**You need to produce a quantity of one product, from a given product specification and production plan. The product must be made from at least two components or different materials. You must also compile a portfolio to show how you:**

a worked as part of an effective team

<b>ASSESSOR'S MARKING GRID</b>							
	<b>Mark band 1 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 2 At this level work must show:</b>	<b>Mark range</b>	<b>Mark band 3 At this level work must show:</b>	<b>Mark range</b>	<b>Mark awarded</b>
<b>(a) AO1 AO3 6 marks</b>	<ul style="list-style-type: none"> <li>that the student contributed to the work of an effective team, and the student's success in meeting some targets</li> </ul>	1 – 2	<ul style="list-style-type: none"> <li>that the student helped build an effective team, and the student's success in meeting key targets</li> </ul>	3 – 4	<ul style="list-style-type: none"> <li>that the student played a leading role in building an effective team, and the student's success in meeting all achievable targets</li> </ul>	5 – 6	<b>4</b>
<b>MODERATOR COMMENTS</b>							
<p>Emma has produced some quite fluent work. There is some evidence of her taking part in team building activities by agreeing roles and responsibilities. There is evidence that Emma had good oral and written communication skills and the witness statement confirms that this team was motivated. Both Emma's notes and the Witness Statement identify that Emma played an active part in team building activities. However it is recognised that she did not readily accept leadership and therefore she did not meet the mark band 3 requirements in this aspect.</p> <p>Much of the evidence for meeting individual and team targets was contained in other portfolio materials. However the Witness Statement identifies that individual targets were met and that most of the team targets were met.</p> <p>Emma should be awarded 4 marks.</p> <p>If Emma had not been capable of fluent written communication it would have been possible for a more detailed witness statement to replace much of the student prepared evidence. This evidence could also have been augmented by written evidence provided by other students.</p>							

You need to produce a quantity of one product, from a given product specification and production plan. The product must be made from at least two components or different materials. You must also compile a portfolio to show how you:

- b used a production plan and developed a schedule for manufacture

## THE ASSIGNMENT GIVEN

### Production plan for candle holders

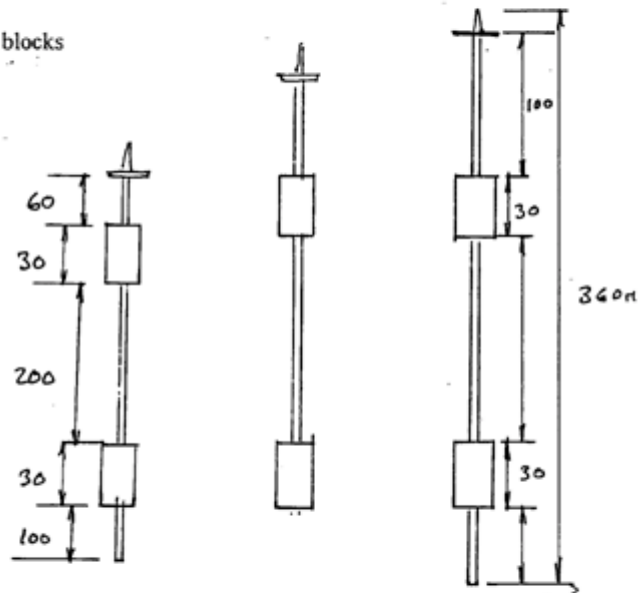
#### Product description.

Free standing, three leg candle leg holder

#### Materials

8mm mild steel bar  
30mm by 30mm mahogany blocks  
5mm thick acrylic

#### Measurements



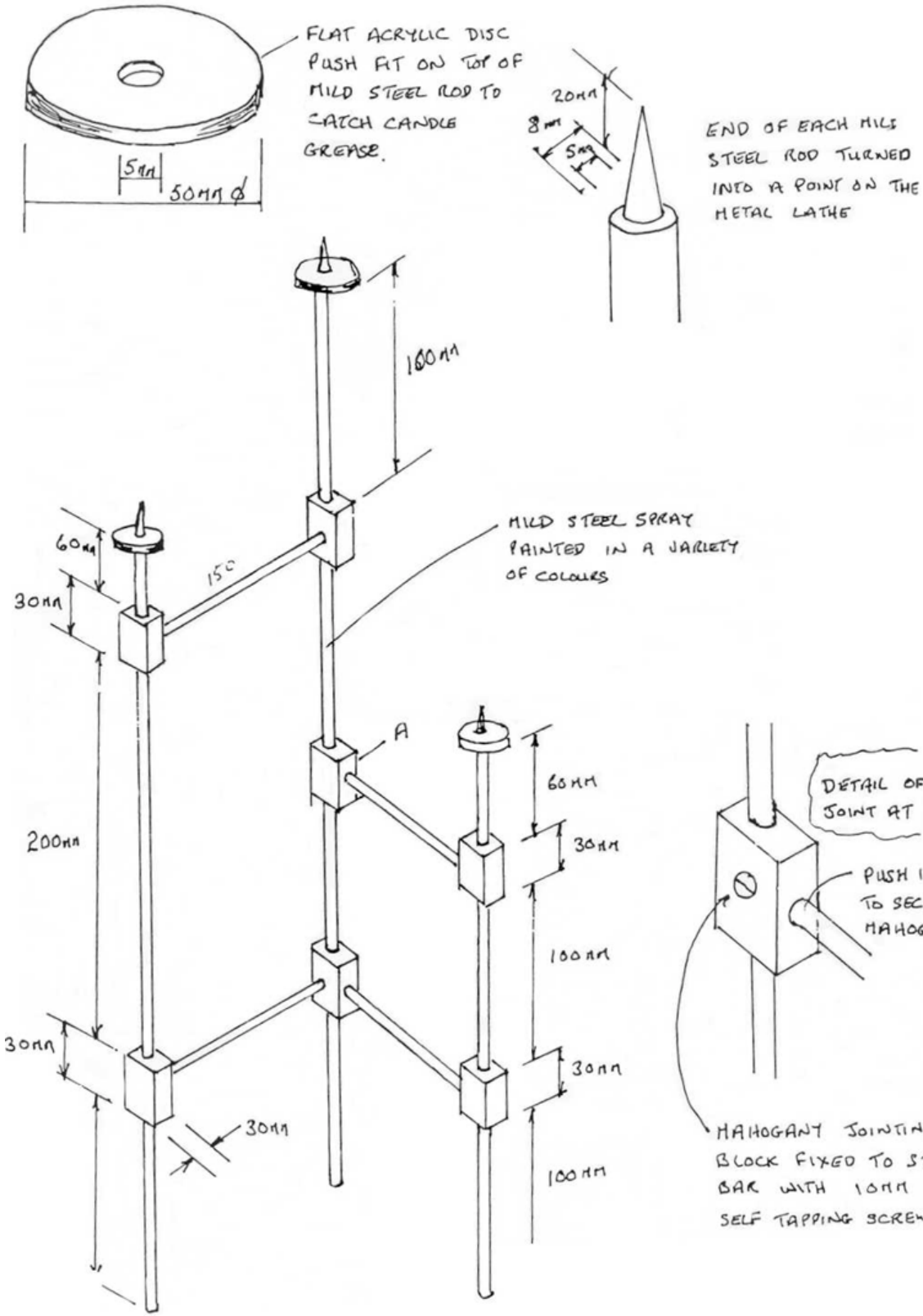
#### Critical control points

1. Quality of materials checked before processing
2. Length of each piece checked after processing
3. Quality of finished checked before assembly
4. Appearance checked before packaging

#### Finish

Mild steel rod: -spray painted in a variety of colours  
Mahogany: -varnished  
Acrylic: -polished on polishing machine

CANDLE HOLDER.



Quality indicators

Critical control points

1

Quality indicator

Steel bar must be straight and Ends square

Mahogany must be split free with the Ends Square

Acrylic must be blemished free

Each piece of material must be accurate to +/- 1mm in length, width and thickness

Finish checked by a visual inspection

Appearance checked by a visual inspection

Key production stages.

Preparation

cut steel mahogany and acrylic to pre determined length - steel

Process

Face off steel to length.  $1 \text{ hour } \frac{1}{2}$  Wood  
Taper turn spigot. Acrylic

Square ends of mahogany on Linisher. 1 hour

Drill necessary holes.  $1 \frac{1}{2}$  hours

Sand surfaces. 2 hours

Cut corners off acrylic. - 30 mins

Drill hole. - 30 mins

Finish to circle on Linisher.

Clean and polish edge. - 1 hour

Finish

Spray paint steel. -  $1 \text{ hour } \frac{1}{2}$

Varnish mahogany. -  $1 \text{ hour } \frac{1}{2}$

Assembly

fix Mahogany to steel with self-tapping screws.

Fix side rails.  $1 \text{ hour}$

Glue on acrylic disc

Finish

Adjust to steady.  $\frac{1}{2}$  hour

## CHI CHI'S WORK

### YR11 MANUFACTURING

#### Resource Requirements

There are 5 types of resource:

Resource	Includes
Capital Resources <i>These include</i>	plant, machinery and equipment  <i>eg: Polisher, mill, drill + former</i>
Human Resources	Are direct involved or indirectly involved. Includes direct production workers, technical support and management.
Material Resources	include raw materials include <del>eg</del> bought in components and consumables. e.g. blades, claths.
Tooling-up Resources	<del>Cutting tools</del> drill bites, Drilling tool, cutting bolts such as lathes and milling machine
Services	Gas, electricity, water + compressed air.

#### Processing Times

These can be calculated using the following formula:


Production Stage Timing		Machine setting-up time	+	{Operation time {per item	x	{Number of items} Produced }
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NB

- All timings must be in the same units (i.e. either minutes or seconds)
- Machine is set up only once per production run
- If identical processes are operating at the same time, we assume that they take the same amount of time to set up and carry out each operation



**Resource Requirement Table**

Type of Production	Resource type Production stage	Capital	Human	Material	Tooling Resource	Services
Preparation Steel	Cut steel to length	Hand saw	1 production worker	8mm mild steel bar/Blades		
Mahogany	cut to length	Tenon Saw	1 production worker	30x30mm Mahogany blocks		
Acrylic	cut to length	Coping Saw	1 production worker	5mm thick acrylic sheet (blades)		
Processing Steel	face off steel turn paper spigot	Lathe	3 production work technician worker.		Tools	electricity
Mahogany	square ends drill holes sand surfaces	Linisher Reckstad drill	2/3 production workers		Drill Bites	electricity
Acrylic	cut corners drill holes finish to circle clean + Polish edges.	Ban Saw P. drill Linisher	3/4 production workers		Drill Bites	electricity
Finish Steel	Spray paint steel	Spray paint	1 production worker.			
Mahogany	Varnish Mahogany	Paint brush	1 production worker.	Varnish		
Acrylic	file down wet + dry Polish	Polisher.	1 production worker.	Polish 30x50 wire wool		electricity
Assembly	Set tapping fix mahogany fix side rails glue on acrylic disc	Screws Driver	1	Self tapping Screws		
 Finish	adjust to fit steady	Screws driver				