

Yr11 Engineering Task

April 2020

- This task is for students who are seriously considering taking the Tech Level Engineering course in the Sixth Form next year. Tech Level Engineering is equivalent in time and qualification tariff to a full A Level.
- The project is the first internally assessed unit of the 2 year Engineering course. The complete project consists of four objectives that normally takes about 25 hours to complete.
- The Engineering course consists of four units and this first unit is worth 25% of the final grade.
- As you complete each of the five tasks please email the document to Mr R Jones. rjones@prioryacademies.co.uk
- The entire unit had about 20 tasks so it is easier to manage if you put all the task in a single document from the start.
- A header with your name and page numbers would be useful.

For any questions or additional guidance please contact Mr R Jones.

This assignment will require you to demonstrate an understanding of the engineering design process and use industry standard tools and techniques to deliver an **engineering design** from start to finish.

You will need to demonstrate problem solving skills and oral and written communication skills.

This project has been set by DMM Climbing Ltd.

<https://dmmclimbing.com/>

The company has identified an opportunity for a new product that can be manufactured in the UK and sold across the world.

The next page describes the opportunity in detail

When people are cooking outdoors after hiking they have to use portable equipment.

DMM have conducted research that shows that people often heat food on their own metal plate instead of carrying a heavy saucepan. —————→

The problem with plates is that they don't have a handle. Picking up a hot plate with your hands results in burns. Metal plates get very hot even if hot food from a pot is added to the plate.

DMM want you to design a detachable device that can enable a person hold a metal plate during heating or when eating food off the plate.

DMM do not sell plates so the device must function safely with ALL types of metal plates.



There is a rival product made in China so in order to boost sales DMM would like the product to also provide light. E.g. torch or flashing beacon.

Objective 1

Task P1

- *The identification of the end user of the product you will design.*

Read the exemplar



Make a new document in word, powerpoint or publisher.

Produce a first page with your name on it.

Complete the task below

1. Write out a brief.
2. Identify all possible end users – minimum of 5.
3. Describe the needs of the end users.

Exemplar – a good one!

Brief

To design a dual function product whose primary function is as a handle for a hot plate that can be used in camping and mountaineering environments, and whose secondary function is as flashing beacon that can be hooked on to clothing or a bag.

P1. Describe the end user of the item being designed.

Camper -

Campers often stay outdoors for large amount of times, over several days. These days often have varied weather conditions meaning equipment need to be corrosion resistant. Camper pack lots of things in to their bags, so a small product would suit them best. The appearance of the product is important as campers tend to like things to look purposeful sometimes with a military look, they would like the product to be fashionable.

Climber / Mountaineer -

A climber / Mountaineer is often in an extreme environment possible on a steep slope or cliff edge. In these areas the weather conditions tend to be harsh and a climber / mountaineer will often wear gloves and thick clothing to protect them from the cold. Climbers / Mountaineers tend to only carry a single bag with lots of items that have multiple uses. These items are small and lightweight so they can be easily carried and not interfere with the person.

Military -

The military often train / have operations in extreme environments away from modern civilisation. For these operations they will need to take everything with them to survive. They often travel without vehicles meaning they need to carry everything with them, due to this they have many items with multiple jobs for example a Swiss army knife. Their items are also light and not bulky so they can be packed into bags.

Objective 1

Task P2

- *The identification of the customer requirements including the functional requirements and key customer benefits .*
- *The design constraints .*
- *The key business goals, including introduction timing, market share and desired financial performance .*

Functional requirements means ‘what is the product you are producing is meant to do’. You could list the main functions. This should be your opinion. Describe the benefits to the range of end users you identified in Task P1.

Read the exemplar to understand what we mean by ‘**Design Constraints**’ Try to think of others as well them produce your own list of constraints.

Other things for you to describe -

How long do you think it would take from you designing it to getting it on the shelves? Justify your opinion.

Do some internet research – how many possible end users in UK, Europe, USA, The world. Its an educated guess but explain your thinking. What would the company DMM have as their success criteria? What makes the venture worthwhile. DMM are not a charity. They have workers and owners that need to earn money! These are called Stakeholder.

Do some internet research to find out what are stakeholders?

Another exemplar – a fairly good one!

P2. Produce a CDB to explore design problems, requirements and design constraints for a specific customer need.

Target market –

- Anyone who participates in outdoor activities which don't involve everyday objects such as ovens/stoves or a table. These activities include mountaineering, hiking, and adventure sports.
- Armed forces for training activities which involve cooking and eating outdoors.
- Survivors of a major humanitarian crisis such as an earthquake or flooding where cooking must occur in the open air with limited resources and equipment.

Customer requirements –

- To hold a plate while it is being heated without injury to the user
- To hold a hot plate stable so that it can be eaten off.
- To be lightweight so it can be carried along with other things for a long distance.
- To flash a bright light when required that can be seen far away.

Design constraints –

- The product need to be able to fit inside a backpack in order for it to be used for mountaineering and other activities. This will mean that the product will have to be small, foldable or easy to disassemble.
- The product will need to be heat resistant so it doesn't get hot when the user is holding it. This will mean that the product needs to be made out of a material that doesn't conduct heat or have a heat proof section for the user to hold on to.
- The product will need to be able to be fixed on to clothing or a bag by means of a clip or hook.

The stakeholders are anyone affected by the development, manufacture, use or disposal of the product. For example, **consider if the design was for a gear stick for a car.**

The direct stakeholder is the user; additional stakeholders (M1) could include:

- **other road users**, who need the product to function correctly so that their safety is not compromised; including pedestrians
- **employees of the manufacturing company**, who have jobs as a result and want job satisfaction;
- **suppliers of materials**, who are seeking a profit;
- **shareholders of the company** who want financial return for their investment.
- **persons responsible for the disposal**, who may want it easy to disassemble so that the parts can be reused or recycled.

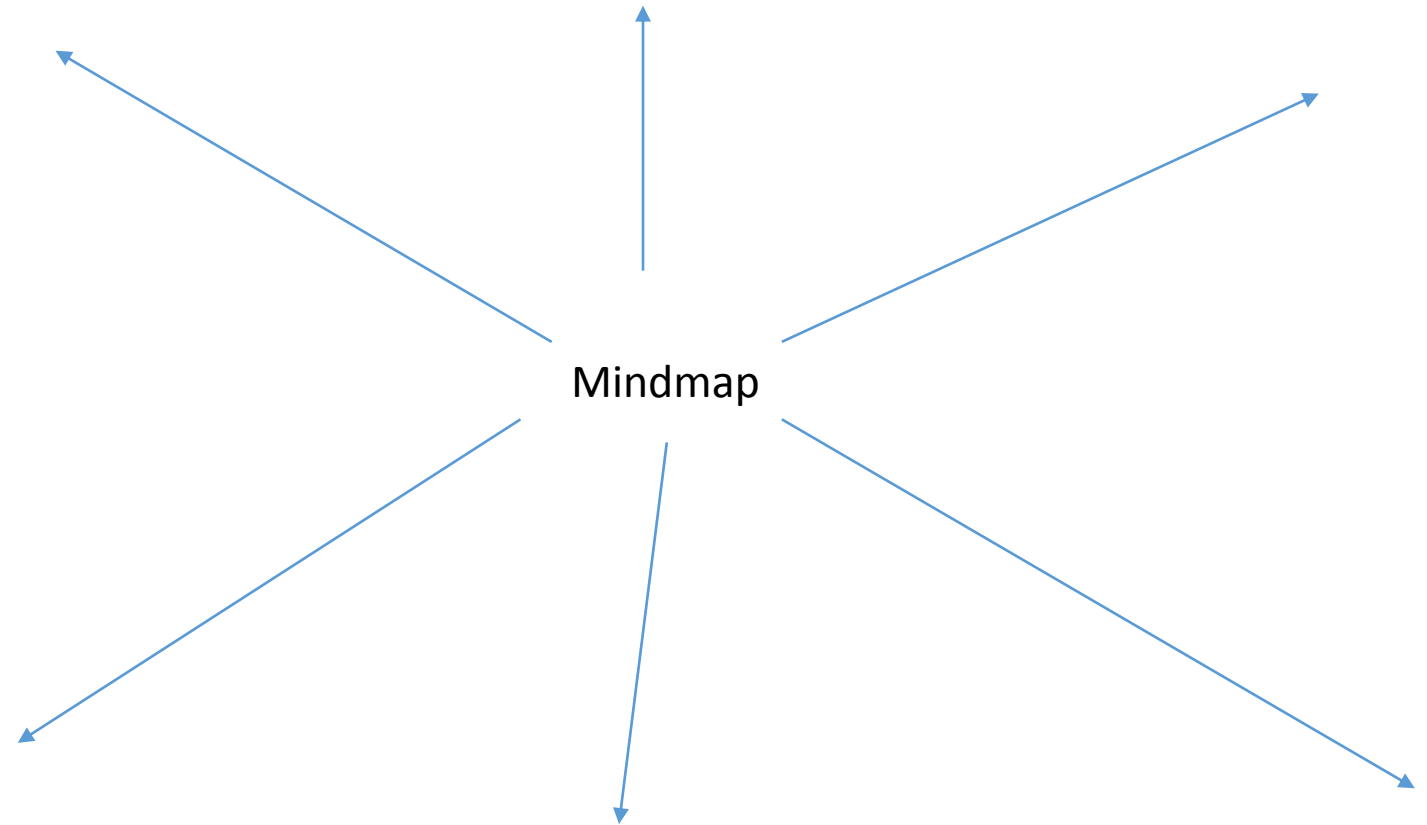
Objective 1

Task M1

- *A list of stakeholders and any of their requirements that need to be included or considered in the development process.*

Remember a stakeholder is ANYONE who has an interest in the success of the product - the owners of DMM, the shareholders, the employees are three but try to list at least another four.

Add a sentence to justify your choice for each one. You can present this information in any way you want.



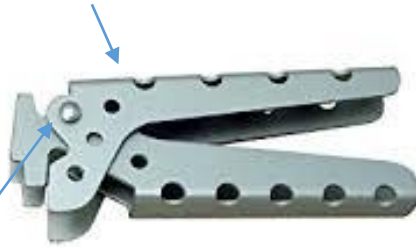
All engineering designers will look at similar products during their initial research. Here are a few. Try to answer these question before starting the next task.

Made from a heat resistant plastic

Why?



Made from steel



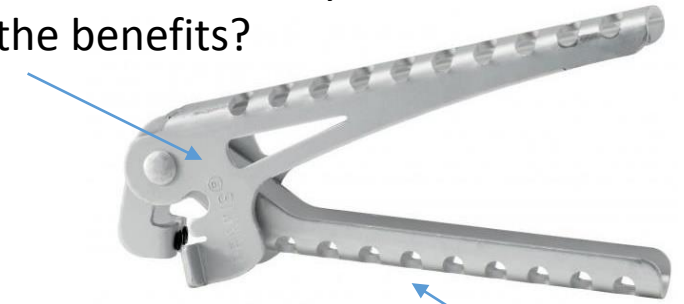
Rivet to make a hinge mechanism



厚さが1mm程のソースパン(ナベ)や、皿をつかむことができるハンドルです。肉抜き加工が施してあり、非常に軽量(50g)です。

Made from aluminium alloy

What are the benefits?



Why the holes?



Anodised aluminium alloy – what does this mean?



Plastic handles
Why?

Plastic pad
Function?

Does this design work with plates too?

Objective 1

Task M2

An analysis of competitive products which identifies their strengths and weaknesses.

Its very hard to identify strengths and weaknesses when you don't have the product in your hand. It's like evaluating a bike without riding it!

An experienced engineer will be able to spot issues just by looking at it. Here are my thoughts on one product.....



Strengths:

1. Lightweight so easier for user to transport around in a bag
2. Good heat insulator so less chance of burning hand due to conduction
3. Low cost to manufacture once the mould has been made
4. Simple for the user to use
5. Easy to keep clean

Weaknesses:

1. Excessive force will snap the plastic, possible if the plate is heavily laden
2. A mould needs to be manufactured which is costly and can take time
3. The angle on the plate grip is only suitable for a pan not a plate
4. Black plastic is not recycleable
5. The plastic could catch fire if too close to a flame
6. Not as durable or tough as metal
7. Plastic is not ecofriendly

Produce your own analysis consisting of four similar products. Make sure you include an image of the similar product. There are many similar products for sale on the internet. You can include cost and safety in your evaluation.

Find out on the internet what is meant by the term ' Product Specification or PDS'
Every product made will have a PDS. The PDS for a cruise ship could have a thousand pages!

Read all the following the information about the PDS.

Product design and development involves a number of processes in order to increase the chances of success once in the market. To do this, the process of product design is initiated with the creation of a product design specification or PDS. The PDS documents all of the necessary requirements and constraints the new design must adhere to. It can also be said the PDS outlines what the market demands of the product and often involves detailed market research. Solutions or concept designs should be generated with reference to the PDS. The number of sections or areas of specification can vary from one design team to another; however there are some recommended headings as detailed below:

Performance

- What does the product need to do?
- What speeds does it need to operate at?
- What loads will it experience?

Cost

- Can the performance required be realised at a reasonable, practical cost?
- Will making the performance specification more lenient help lower the cost?

Target production cost

- Estimate the realistic cost of making your product, including materials, manufacturing processes and down-time
- Analyse competing products currently on the market

Environment

- What type of environment will the product be subjected to?
- What is the ambient temperature, pressure and humidity?
- Is there dirt, dust or insects?
- Are there any corrosive fluids or chemicals?
- Is any vibration or noise expected?
- Wear and tear?
- What about storage and transit?

Size

- Maximum allowable size of the product? Use millimetres.

Weight

- What is the allowable weight range of the product? Use grams

Maintenance

- Is there any maintenance required? If so, how much is the customer expected to be able to carry out?
- Parts that need maintenance will need to be easily accessible

Material

- Specify any special materials to be used?
- Specify material restrictions or those to avoid in the interest of safety i.e. toxic

Ergonomics

- The product must be easy to operate, handle, adjusted, maintained and so on
- The hand size and strength are amongst the variables of the target user that must be considered

Appearance

- The appearance of a product is one of the most important aspects in the customer buying process and can often make all the difference when compared to a similar product
- The product may need to be compact, easy to use and look robust

Finish

- Specify the colour options and surface finish required

Quality and reliability

- Quantify by looking at similar products

Industry standards

- Which countries / regions of the world is your product intended to be released?

Testing

- Specify any planned tests that need to be carried out such as corrosion tests, accelerated life and fatigue testing

Safety

- The product should be designed for safe operation eg Is hygiene an issue?
- Safe operating instructions should be mentioned clearly in any literature and/or on the product itself

Manufacturing

- How many units are required to be produced?

This affects production costs and can even mean alternative manufacturing processes need to be considered. What DMM have said – Metal bending, sheet cutting, riveting, hand tools, CNC lathe, welding all available.

Product life span

- Estimate how long the product is to stay on the market

Customers

- Are there any customer demands?
- Focus groups or questionnaires are often used to find this information out and can mean greater success for the product
- How long do you intend the product to last?
- How often will it typically be used and at what rate will it operate?

Objective 1

Task P3

A Product Design Specification (PDS) that covers all the requirements of a product, uses key terminology and considers feasibility and costs.

It is best to produce a PDS in the form of a table as shown below. Use the same titles. Note that the best work includes a plan of research tasks that will or have already been carried out.

P3

	Specification Point	Justification	Research Tasks
Function	The product must hold a plate securely and attach and detach easily. The handle should be level with the plate.	The product must be secure to avoid any accidental drops of the plate, especially while being heated or used to eat with to avoid any potential injuries.	I will conduct extensive research into how well different existing products hold plates and how they achieve this.
Aesthetics	The product must look ergonomically attractive, enticing and should appeal to all of my target market. It should not be too ostentatious and should have a basic, natural colour scheme.	Aesthetics are important as they have a huge impact on the customer's willingness to buy a product. Therefore to maximise the possibility of sales, it should be appealing.	Research into aesthetics will be done, including looking at existing products and asking potential customers what their preferences are.

This is the last part of Objective 1
Submit this for assessment by your teacher