

Yr11 to Yr12 Engineering Task

June 2021

- This task is for students who are seriously considering taking the A Level OCR Design Engineering course in the Sixth Form next year.
- The Engineering course consists of two examined units and a coursework (project) unit worth 50% of the overall grade.

For any questions or additional guidance please contact Mr R Jones
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This pre-course 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**

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.

Task

- *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

Another exemplar – a fairly good one!

Task

- *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 the first task

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.

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 could include:

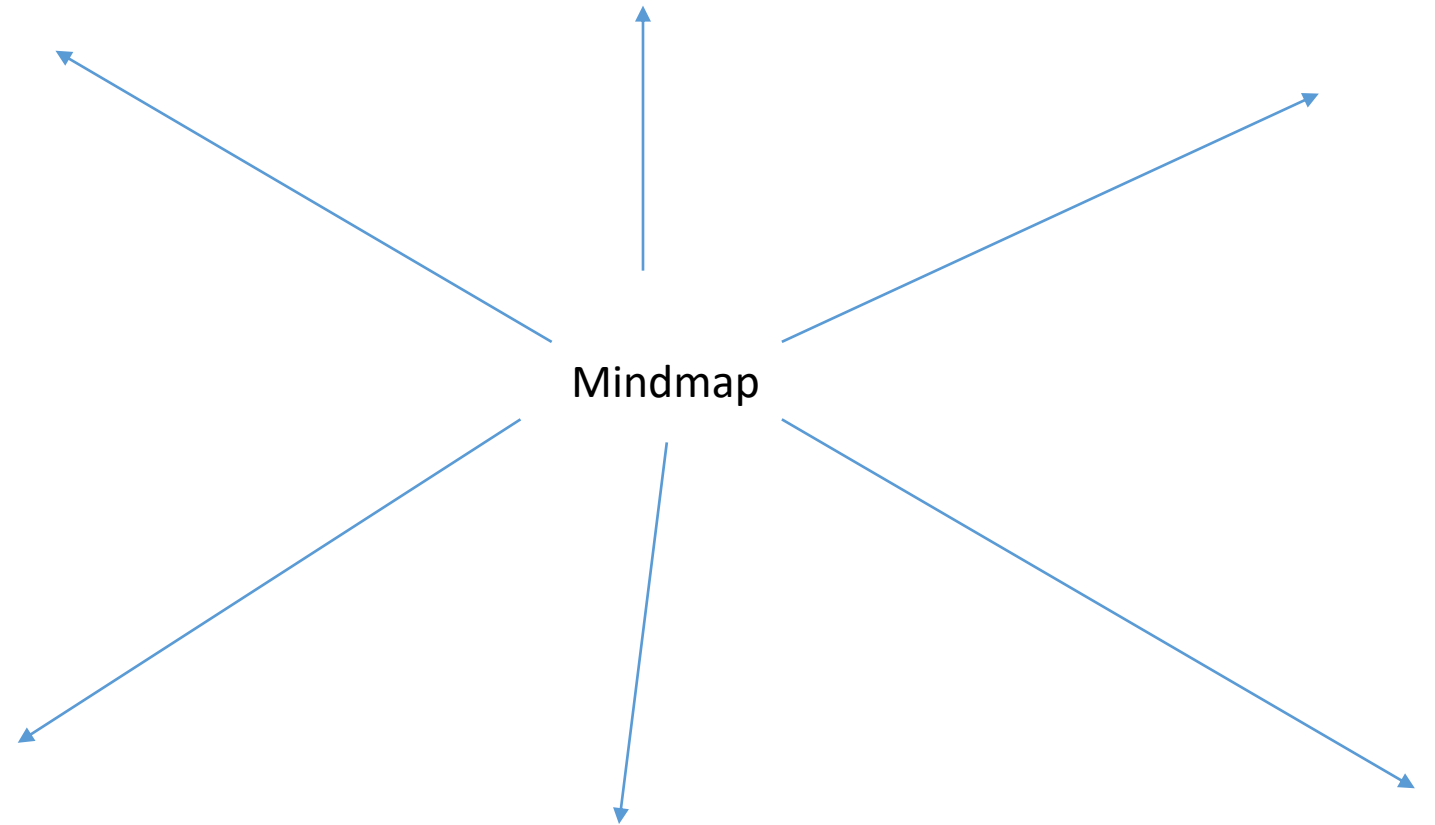
- **other road users**, who need the product to function correctly so that their safety is not compromised; including pedestrians
- **employees of the manufacturing company**, who have jobs as a result and want job satisfaction;
- **suppliers of materials**, who are seeking a profit;
- **shareholders 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.

Task

- *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.

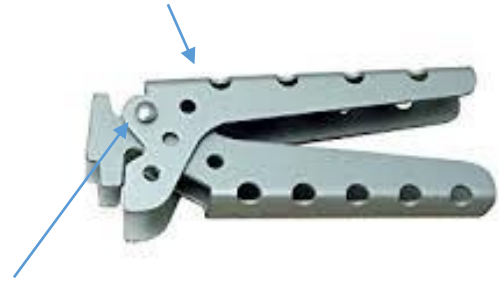


All engineering designers will look at similar products during their initial research. Here are a few. Try to answer these question before starting the next task.

Made from a heat resistant plastic
Why?



Made from steel

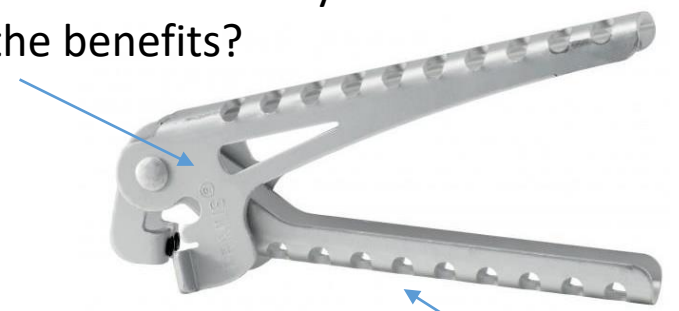


Rivet to make a hinge mechanism



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?

Task

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 recyclable
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.

Before designing – read this product specification.....

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?

Task

- *Produce a design that fulfils the requirements of the brief*

You can either draw some views of an idea you have on A4 paper and photograph it or produce the drawing using a CAD program

When complete email your completed task to Mr R Jones
rjones@prioryacademies.co.uk