Industrial Technology

GCSE Major Project

Design Folder Writing Frame

A support guide for students

Injection Moulding Die Kit

Design Folder Checklist

You must have the following work in your design folder to be able to reach the higher marks.

The presentation of your design folder will have an affect on your mark, as you are marked on the standard of your communication. In Design Technology communication is **BOTH** visual and written.

- A detailed situation – [given]
- Design Brief – [given]
- Task Analysis - Spider diagram brainstorm of the intended users and
- *Research 1* - Injection Moulding Products AND Show the artefact to be moulded
- *Research 2* - Injection Moulding Process (How it works)
- *Research 3* - Existing Injection Moulding equipment
- *Research 4* - Experiment with Injection Moulding Kit
- *Research 5* - Plastics for Injection Moulding – Including Health and Safety
- *Research 6* - Mechanisms
- *Research 7* - Pneumatics
- *Research 8* - A survey
- Research Summary
- Product Specification
- Initial design ideas – At least 6 using rough sketches exploring ideas
- 4 design ideas - draw up in neat
- Evaluation of ideas summary & check against specification

- Development - 1 design developed over a series of sketches
- Models from the design development A final design drawn in 3D, in neat, and rendered.
- Final design drawn in 3rd angle orthographic projection with dimensions
- An exploded / assembly drawing of the final design
- A final specification
- A cutting list
- A detailed and illustrated production plan
- *[A complete product made to a high standard]*
- Third party evaluations
- Testing
- Final evaluation
- Suggested modifications / improvements

The following pages will outline what should be included within each of these pieces of work.

When all the work for a section is completed, and checked by your teacher, it will be checked off your progress record.

Use the bordered template sheets provided for your work. They have been printed for you and are also on the school network shared area.

A detailed situation/Introduction

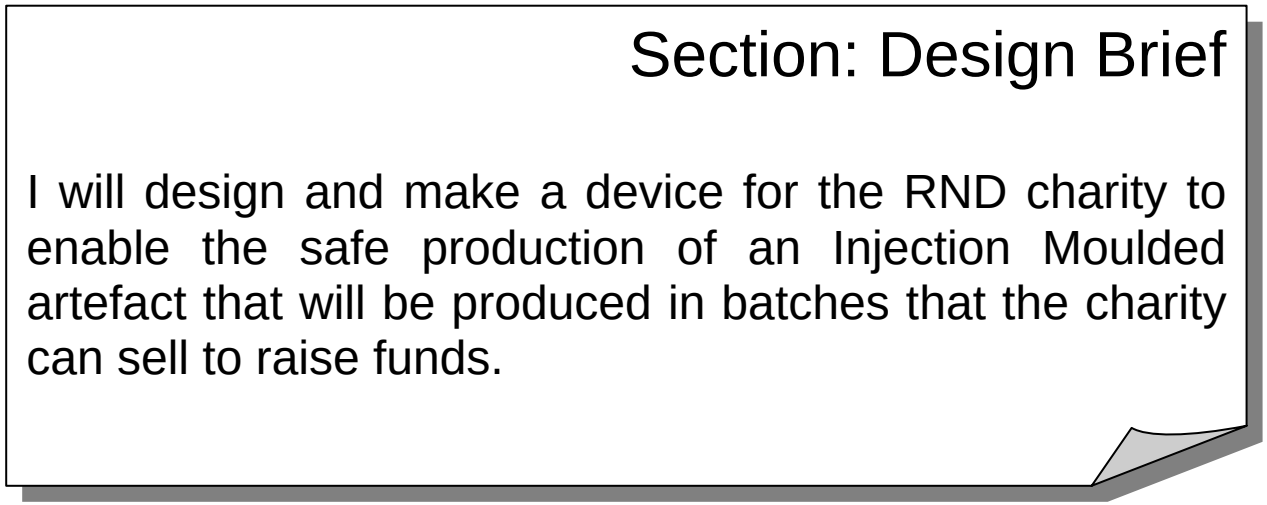
Your situation is unique for your course, as it is set by the exam board. It needs to be word processed and mounted into your design folder.

Section: Situation/Introduction

I have been asked by the RND charity to design and manufacture a fully workable device that they could use to manufacture small artefacts that they can sell to raise money for charity. The device must be some kind of ‘Injection Moulding system’ that will allow the user to safely manufacture batches of high quality artefacts from plastic that will be sold to raise funds for their charity.

Design Brief

The exam board has also set your design brief. It needs to be word processed and mounted into your design folder. It can be included on the same sheet as your Introduction.



You are not required to design the mould plates for the artefact. You will however, need to modify its design to suit your needs when designing the holder for the plates. You need to design how the holder/device will work. For testing you will need to injection mould the artefact.

Task Analysis

- This could be produced in a spider diagram format.
- It should be a brainstorm of all the things that you can think of about the people that your product will be designed for and anything else related to injection moulding and manufacturing:

Section: Task Analysis

- Who will operate the device - Age guide – over 18?
- Charity wanting to produce own products
- People whose business is small scale
- Could be used by small novelty product companies
- be easy to use for both left handed and right handed people
- be light enough to carry / hold in hands
- be safe for people to use
- be easy to operate
- be hand operated
- be an affordable product to buy
- be attractive to look at
- mould plastic using hot glue gun
- be accurate
- be easy to maintain
- have a long life expectancy
- be well made

Research 1 - Injection Moulded Products

- This should include photographs or drawings, of several Injection Moulded products / Artefacts already available that have been manufactured using the Injection Moulding process.

- One of the products MUST be what you will be manufacturing with your Injection Moulding kit.

Section: Research 1 - Injection Moulded Products

- Using the Internet find examples of products that have been Injection Moulded and show pictures of them with some details about them e.g. uses, materials size, cost etc.

- Show some examples of the type of product **YOU** will need to produce with your Injection Moulding kit. **STICK THESE INTO YOUR FOLDER.**

Useful web site: www.design-technology.org/examples

Research 2 - Injection Moulding Process

- You must show that you have an understanding of the Injection Moulding process, how it works and its limitations and advantages.

Section: Research 2 - Injection Moulding Process

- Using the software on the school network (Focus on Plastics), produce a sheet showing the Injection Moulding Process.
- You should include animation stills, pictures from the programme and text.
- Include the TERMS used in the Injection Moulding industry.

- Useful web sites: www.design-technology.org/injectionmoulding
- www.withersd.demon.co.uk/plasticsdex.htm
- Software (School Network): Focus on Plastics

Research 3 - Existing Injection Moulding Equipment

- You should show pictures and details of at least 3 different types of Injection Moulding equipment already available. They could include any type of equipment used in the production of Injection Moulded products.

Section: Research 3 - Existing Injection Moulding Equipment

Show each one on a separate page

- Label all the features of each one such as; what is it made out of, what type of finish has it got, how do you use it, is it hand held or to be sat on a work surface, what product does it make, can it be adjusted in any way, what type of material does it mould, how easy is it to use, are there any safety features.
- You need to produce a conclusion to the analysis of the existing products. Compare what you have found out about each one, and what features worked best. Write a good paragraph summing up your findings.
- It needs to be word processed and mounted into your design folder.

Research 4 - Existing product (Experiments)

- Using the ‘testing’ handout sheets provided, carry out a range of tests on the TEP Injection Moulding Kit. You must keep a record of your findings as you will base your own testing on this test when you have completed the manufacture of your own kit.

Section: Research 4 - Existing Product (Experiment)

Use TEP Test Sheets (There are 4 sheets)
Rewrite the sheets neatly for your folder.

- Planning Test
- Obtaining evidence
- Analysing Evidence
- Evaluating Evidence

Use sketches and photographs to illustrate your findings.

Research 5 - Plastics used for Injection Moulding

- Gather information (Table form would be great) to show the range of plastics available for Injection Moulding. Don't forget to include the 'GLUE STICKS' you will be using for your artefact. (Vinyl Acetate)

Section: Research 5 - Plastics used for Injection Moulding

Your table should include the following information:

- Thermo and Thermosetting plastics
- Mechanical Properties and working characteristics
- Uses
- Finishes
- How it is supplied e.g. Granules, Sticks, Powder Quantities etc.
- Materials for the future (Smart Materials)

ALSO INCLUDE

Health and Safety when using hot/molten plastics (see www link below)

- www.fospat.co.uk/healthandsafety.asp
- Software (School Network): Focus on Plastics
- Working with Materials – Wood/Metal/Plastic (Collins Real-World Technology)

Research 6 - Mechanisms
Investigate Levers, Linkages and Cams

- You need to investigate a number of different mechanisms that you could use within your product to create movement.

Section: Research 6 - Mechanisms

- Use the school network and open the ‘Focus on Mechanisms’ program. Research different mechanisms.
- You can use the illustrations from the program to explain how various mechanisms work.
- You could also use models of different mechanisms to show the movement that they create.
- Levers, Linkages and Cams can all be used in your product.
- You should also investigate how one motion can be changed into a different type of motion.
- Include some calculations on your sheets.

- Software (School Network): Focus on Mechanisms

Research 7 - Pneumatics

- Include this section if you are intending to use pneumatics for your design. It is not a requirement but you will have an opportunity to get higher marks.

Section: Research 7 - Pneumatics

You should investigate:

- Pneumatic Systems
- Symbols
- Cylinders – single and double action
- Three port valves
- Controlling speed of cylinder piston travel
- Safety provision e.g. operator to operate two valves to make cylinder work.
- Safety using pneumatics and compressed air

Include diagrams, schematics and pictures of components.

- Software (School Network): Crocodile Clips

Research 8 – Survey

- You need to carry out a survey, based on existing products that you have already evaluated. You could use the TEP kit and ask others what they thought about using it.

Section: Research 8 - Survey

Devise 5 questions you could ask a range of people [10] about the Injection Moulding equipment that will give you some useful information about what people like to see. One copy of your questions should be word processed and mounted into your design folder.

Ask your questions, and collate the answers. Produce bar or pie charts using the computer to show your results. Print the results off, and mount them into your design folder. [NB: the charts should all fit onto one of your pages – do not make them big]

Write a conclusion about how you can use what you have found out, and mount it in your design folder next to the results.

Research Summary

- You now need to summarise your research findings before producing your specification.

Section: Research Summary

- Write a paragraph summarising what your research tells you.
- STATE THE OBVIOUS.

Product Specification

- A specification is a list of all the things that your product should incorporate / fulfil.
- It is word processed, and set out in a bullet pointed list, like the example below:

Section: Product Specification

The product must:

- Be safe for people to use
- Be easy and quick to operate
- Hands free operation
- Be able to use Hot Melt PVA glue from glue gun
- Produce a high quality plastic artefact
- Be able to interchange die to accommodate different designs of artefact
- Be attractive to look at
- Be comfortable to use
- Be light enough to carry and store
- Ensure quality of artefact throughout batch
- Have a 5 year life expectancy
- Be made to a high standard
- Be made mainly in metal
- Be suitable for batch production

Add any other of your own to the list – such as must produce little waste (environmental)

Initial design ideas

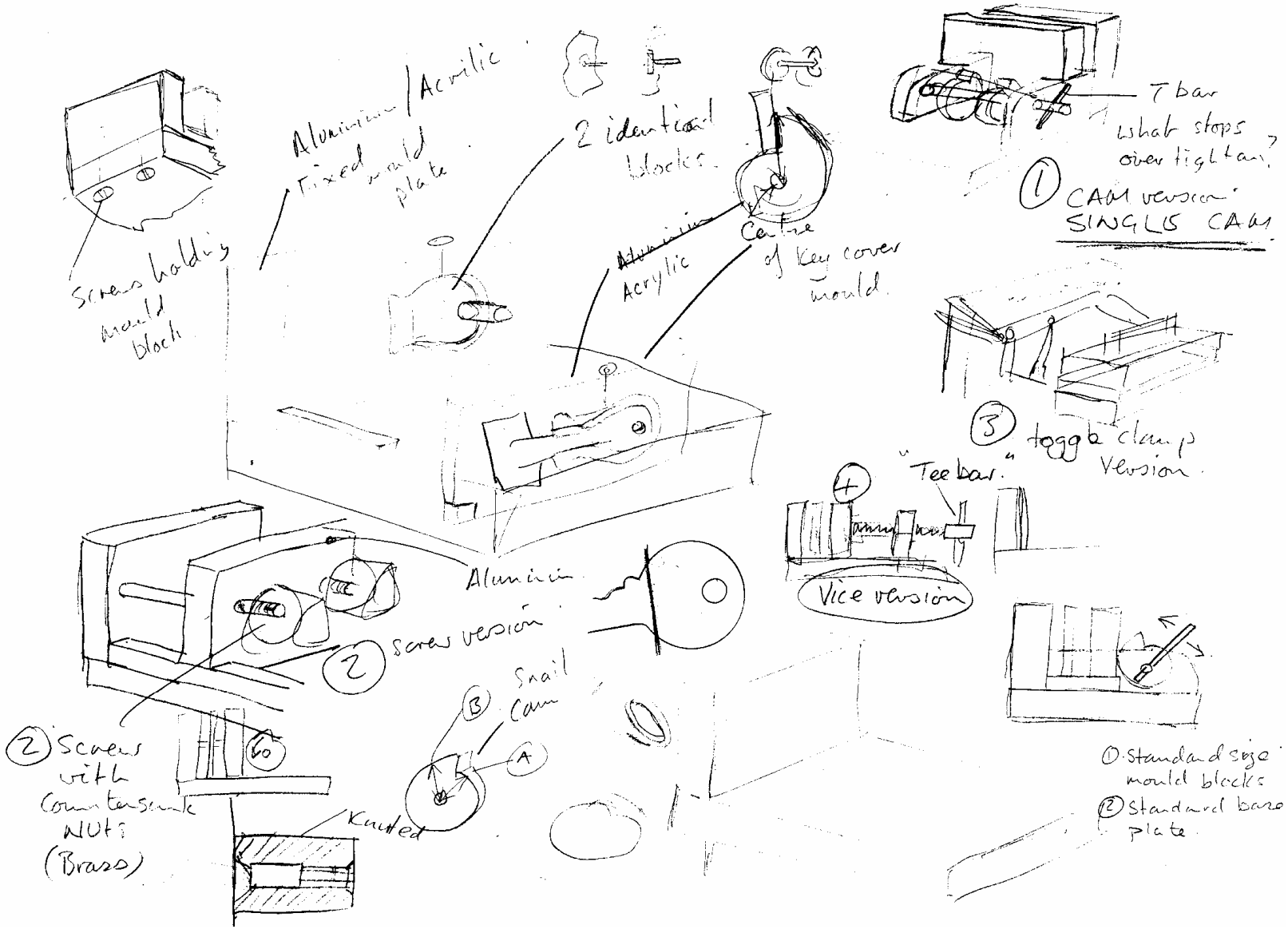
- You need at least 6 first design ideas for your own embossing tool. This is because your exam board marking scheme asks for a range of ideas.
- Sketch different ideas suggesting different ways in which to hold and locate the die/Injection Moulding plates.

Section: Initial Design Ideas

- You should simply sketch your ideas on two to three pages within your design folder. Use a normal ‘H’ lead pencil. Try to draw your ideas boldly, not too small, and use pencil shading and 3D techniques to enhance them and make them look more interesting.

- You should annotate your ideas by writing notes around them, in normal pencil, explaining how they might work, pointing out any features such as finger grips etc., suggesting possible materials to make them from, suggesting possible mechanisms etc.

- Your sketches are just for exploring your ideas using ‘hairy sketches’. You do not at this stage need to draw using rulers etc but YOU MUST ANNOTATE !



4 Design Ideas

- You should choose the 4 best ideas you have. You need to present these properly.

Section: 4 Design Ideas

- Draw one idea to a page in 3D.
- Make your drawings fill the centre of each page
- Sketch them very lightly first
- When you are happy with them, colour them in or shade them
- Annotate all the features of each design, in pencil around the drawing, using arrows to point them out: Size, Strength, Colour, Materials, and Shape Safety etc.

Don’t forget – The die plates are already designed; all you need do is modify them to suit your preferred method of holding them together.

Evaluating Design Ideas

- You should choose the 4 best ideas you have. You need to present these properly.

Section: Evaluating Design Ideas

- **Evaluate each of your ideas against the product specification**. A good tip is to print a small mini print out of your specification and stick it onto each design page. Then tick off all the points that design meets. If it does not meet some of the points say how you could change it, to make it meet them all.

  Don’t forget – The die plates are already designed; all you need do is modify them to suit your preferred method of holding them together.

Developing your design

- You need to choose 1 of your design ideas to develop into a final design.

Section: Development

Use sketches to work out how you could improve it.

- Annotate your final idea drawing labelling ALL parts stating their: Function, Materials to be used etc.
- Could it be a better shape, be a better colour, be a more suitable size, be safer to use, use a different mechanism, etc..
- Explain how it might be made in the real world (Made in a factory)
- Part of the development stage requires you to **model your design.** You could use air drying clay to work out the size of your product for real, or help you make the shape of it better.
- Photograph your models using the digital camera. Mount the photos into your design folder, and explain what you were doing.
- You could use card, wood and bits of metal to help you work out the mechanisms, sizes, how it can all be fixed together etc.. You need to mount any flat models into your design folder, and **photograph** 3D models with the digital camera, and then mount the photos into your design folder. Explain what you were trying to work out

The final design

- You need to give a number of different types of information about your final design to communicate it. Using **PRO-DESKTOP will save time and gain marks.**

Section: Final Design

- You need a 3D drawing
- You need to do a drawing of your final design in 3rd angle orthographic projection, with dimensions on in mm.
- You need to produce an exploded diagram, or a series of sketches showing how all the parts of your product will be fitted together.
- You need to give details of the processes that you will use to make each part of your product. (List using part numbers)
- What finishes will the product need – polished, self finished, painted etc..
- A final specification. This needs to be word processed and mounted into your design folder.

Cutting list

- You need to produce a cutting list giving the details of all the materials that you will need. This will be collected in and given to the department technician to prepare for you. The cutting list will be returned with your cut materials, and needs to be mounted into your design folder. YOU SHOULD USE STANDARD SIZE MATERIALS AVAILABLE IN THE WORKSHOP WHERE POSSIBLE.

It should be set out in a table like this:

Section: Cutting List

Part Number or Description	MATERIAL	WIDTH	LENGTH	THICK	QUANTITY REQUIRED
1 - Base	Sheet aluminium	10 mm	50 mm	5 mm	5

Detailed production plan

- You must show that you have planned out how you will make your product in detail.

Section: Production Plan

- Your production plan should be a step by step plan explaining how you will make your product. [Word process your plan leaving gaps for you to draw pictures in]
- It should use sketches to illustrate some of the steps.
- It must include the use of specialist terms – the names of materials, tools, machines and other equipment / components.
- It should include health and safety points at each stage throughout the plan.
- It should include quality control checks at each stage throughput the plan checking for accuracy and fit.
- You must include the times for each step

The product- Realisation (Making)

This is the most important stage for your coursework.
You must make your product to a high standard.

- It must be complete
- It must meet the requirements of your specification
- It must work
- It must be a quality product
- It must be ‘Safe to use’
- It must have ‘Instructions for use’

Third party evaluations

When your product is made you need to find out what people think of it. To do this you can either:

Section: Evaluation

- Do another survey using 5 questions about your product, with results and a conclusion in the same way as the initial survey.

- Carry out intended user interviews. Ask 4 or 5 people to look at your product and tell you what they like / dislike about your product. Type up what they say, and then write a conclusion summing up the response to your product.

Testing

Your product needs to be tested – Remember the Injection Moulding Kit you tested earlier?

Section: Testing

- Devise some questions about your product, and get 5 people to test it out and answer the questions. You need to mount one copy of your test questions into your design folder. (word processed)

For example :

- Is it easy to use?
- Is it safe to use?
- Do you feel it works well?
- Does it hold the die plates securely?
- etc

You need to digitally photograph each person using your product, and mount them into your design folder.

Final evaluation

You need to compare your finished product to the product specification.

Section: Final Evaluation

- Say how it meets each point
- Say if it does not meet any of the specification points
- Summarise the findings from your third party evaluations and the testing. Has your product been successful, what are its best features etc…

Suggested modifications / improvements

You need to end your project by stating how you would change [modify] or improve your product.

Section: Modifications and Improvements

- You may want to consider points like: the finish – is the paint even, is the colour suitable, does the paint need protecting to stop it scratching off easily, is the shape attractive – could it be improved, could it be easier to use, is the size right – does it need to be a bit bigger / smaller, does it work well – if not how could this be improved, does it hols the Injection Moulding die tightly enough, is it easy to get the plastic artefact out – does it hurt your hand or fingers, are all the edges really smooth – could they be improved – does it allow for speedy extraction of the artefact etc…

- You should produce a detailed list of at least 8 improvements / modifications.

Tips for producing a good design folder

- Remember than your coursework throughout Year 11 makes up 60% of your GCSE grade. You have to be focused on meeting your deadlines throughout the year to complete this major project successfully.

- Missing a deadline, for any reason, will not be accepted. You will find yourself having to catch up after school, and still having to go home and complete the work for the next deadline so you don't miss that one either.

- A letter will be sent home, or a phone call made, to inform your parents / guardians every time a deadline is missed. This will then be followed up within the school.

- If your handwriting is not neat, use ICT to word process your evaluations / work, and cut them out and mount them into your design folder. This will look better.

- Your page titles should be word processed and stuck onto each of your design folder pages.

- Keep your pages flat and clean. Do not smudge them or squash them into your folder in a hurry, you will make it look like you haven’t taken much care over your work.

- Make sure you have everything in your design folder on the checklist. Every piece of work that is missing means that your project can get less and less marks. Remember that your design folder is the majority mark.

- If you want help, advice or ideas to improve then ask – we want to see you succeed.