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Pearson BTEC Level 3 Nationals Extended Certificate									

# Engineering

## Unit 3: Engineering Product Design and Manufacture

**Part B**

Window for Supervised Period: 08/05/2017 to 19/05/2017 <b>Controlled hours: 8 hours</b>	Paper Reference <b>31708H</b>
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**You must have:**  
 Information Booklet containing engineering drawings, **black ink** or ball point pen, HB or B pencil, ruler, eraser, drawing instruments and calculator.

Total Marks

### Instructions

- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- You will need your research notes from **Part A** (maximum two A4 sides).
- **Part B** should be undertaken in 8 hours under supervision over no more than 5 consecutive days. The supervised sessions take place in the two-week period timetabled by Pearson.
- **Part B** contains material for the completion of the set task under supervised conditions.
- **Part B** is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- **Part B** should be kept securely until the start of the 8-hour supervised assessment period.
- You must not submit your research notes to Pearson.
- Complete **all** activities.
- Answer the activities in the spaces provided  
 – *there may be more space than you need.*

### Information

- The total mark for this paper is 60.

Turn over ►

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**Pearson**

## Instructions to Teachers and/or Invigilators

This paper must be read in conjunction with information on conduct for the task in the unit specification and the BTEC Nationals Instructions for Conducting External Assessments (ICEA) document. For further details please see the Pearson website.

The set task should be carried out under supervised conditions.

Work should be completed in this task booklet, using additional sheets, in a supplied template.

Learners can use individually prepared research notes (maximum two sides of A4) to support the supervised assessment (**Part B**). These research notes must be kept secure once the supervised assessment has begun.

All learner work must be completed independently and authenticated before being submitted to Pearson by the teacher and/or invigilator.

Centres are free to arrange the supervised assessment period how they wish, provided the 8 hours for producing final outcomes are under the level of supervision specified, and in accordance with the conduct procedures. The assessment must take place in a two week period set by Pearson, once the learner has started **Part B** the assessment must be completed in a 5 day period.

Refer carefully to the instructions in this task booklet and the Instructions for Conducting External Assessments (ICEA) document to ensure that the assessment is supervised correctly. An authentication statement will be required confirming that learner work has been completed as directed.

Learners must not bring anything into the supervised environment or take anything out without your knowledge and approval.

Centres are responsible for putting in place appropriate checks to ensure that only permitted material is introduced into the supervised environment.

### Maintaining security

- For **Part B**, learners **must not** have access to computers or the internet.
- Learners can only access their work under supervision.
- Any work learners produce under supervision must be kept secure.
- Any materials being used by learners must be collected in at the end of each session, stored securely and handed back at the beginning of the next session.

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**Outcomes for submission**

One task booklet will need to be submitted by each learner, which includes the following tasks:

- the project planning and product design changes made during the development process
- an interpretation of the brief into operational requirements
- a range of initial design ideas based on the client brief
- a modified product proposal with relevant design documentation
- an evaluation of the design proposal.

A fully completed authentication sheet must be completed by each learner.

Learner notes will be retained securely by the centre after **Part B** and may be requested by Pearson if there is suspected malpractice.

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## Instructions for Learners

Read the set task information carefully.

You must plan your time accordingly and be prepared to submit all the required evidence by the date specified.

You may use your preparatory work from **Part A** to complete the set task in **Part B**.

**Your preparatory notes from Part A must not be submitted with the task booklet from Part B. Only your task booklet from Part B will be submitted to Pearson for marking.**

You will complete this set task under supervision and your work will be kept securely during any breaks taken.

For **Part B**, you **must not** use computers or the internet.

You must work independently throughout the supervised assessment period and must not share your work with other learners.

In the information booklet you will be provided with drawings of the sprinkler component and the jig.

### Outcomes for submission

You will need to submit one task booklet on completion of the supervised assessment period, which includes the following activities:

- a record of the project planning and product design changes made during the development process
- an interpretation of the brief into operational requirements
- a range of initial design ideas based on the client brief
- a modified product proposal with relevant design documentation
- an evaluation of the design proposal.

A fully completed authentication sheet must also be submitted; any prepared notes must not be submitted with the final outcomes to Pearson.

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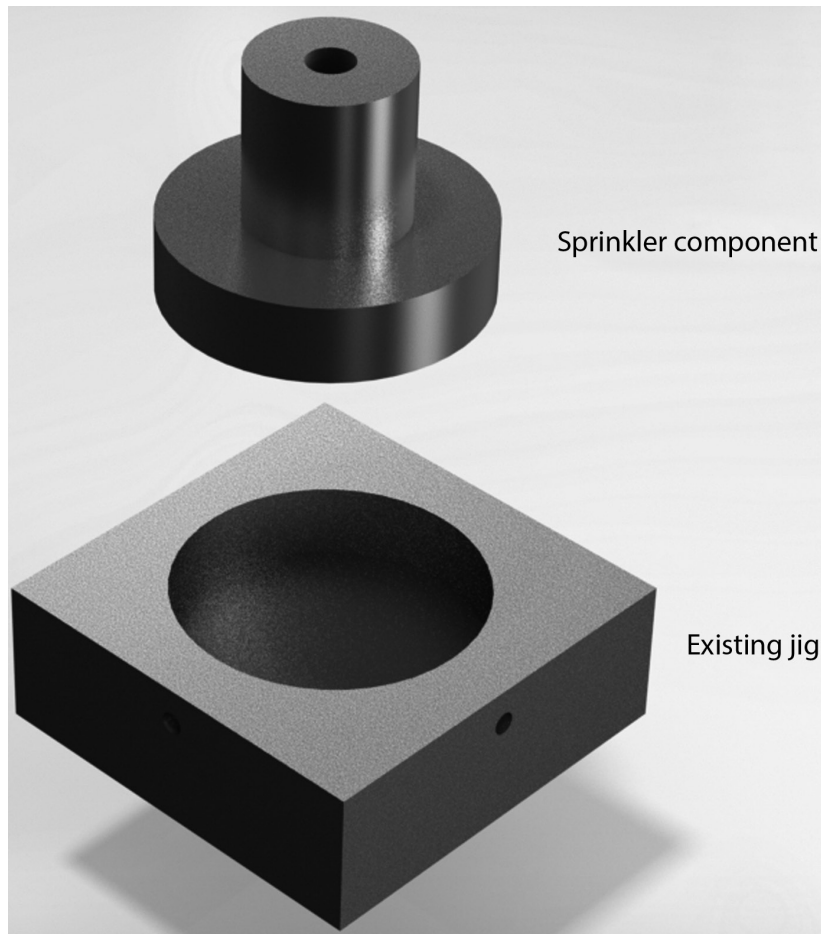


### Part A Set Task Brief

A machine shop supervisor has asked you, as a junior tooling designer, to redesign a jig that is not working effectively.

### Part A Set Task Information

The product is a jig. The jig holds a sprinkler component when it is drilled. Operators place the sprinkler component into the jig to drill two  $\varnothing 3$  mm holes using a bench drill. The jig itself is held in a machine vice that is clamped to the bench drill table. Currently, the jig is made from low carbon steel and there are six jigs in use at any one time, with a number of spare jigs available. The sprinkler components are made from aluminium alloy, manufactured in batches of 1000, and are used in washing machines and dishwashers.



**Jig dimensions: L= 56 mm, W= 56 mm, H=20 mm**



## Part B Set Task Information

For **Part B**, you are allowed to use your individually prepared notes from **Part A** to support you during the supervised assessment period.

In the information booklet you will be provided with drawings of the sprinkler component and the jig.

### Client brief

The machine shop supervisor is aware that the current jig has a number of issues, but the redesign has been triggered by complaints from washing machine manufacturers that the  $\varnothing 3$  mm drilled holes in the sprinkler component are not positioned correctly. The bench drill operators have provided feedback to the machine shop supervisor that the jig is not effective for a number of reasons; these include problems with holding the sprinkler component securely and drilling the holes in the correct position and to the correct size. The machine shop supervisor needs the tooling designer to identify all of the reasons why the jig is not effective and design a solution that solves the current issues.

The bench drill operators use a gauge to check the size of the  $\varnothing 3$  mm drilled holes in the sprinkler component. They have reported that the holes in the sprinkler component change in size after the jig has been used for a period of time. The machine shop supervisor asked each of the operators to measure and record the size of one of the  $\varnothing 3$  mm holes after every 10th sprinkler component had been drilled using their jig. The information provided by the machine shop supervisor is found in Table 1, which can be used to perform a statistical analysis of drilling precision.

The machine shop supervisor has asked the tooling designer to come up with an alternative solution for the jig that can also take into account the most efficient use of materials and manufacturing processes; however, the tooling designer also has an opportunity to optimise the design in terms of form, sustainability and other factors.

The jig **must**:

- be able to be held in a machine vice or clamped to the table of the bench drill
- hold the existing design for the sprinkler component
- allow the  $\varnothing 3$  mm holes to be drilled accurately into the existing sprinkler component
- enable the operators to complete the drilling process safely and quickly for each sprinkler component
- be capable of being manufactured in small batches.

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Table 1 – Drilling precision based on bench drill operator measurements

Bench drill operator	Coolant (Yes/No)	Spindle speed (rev/min)	Hole size (mm) after $x$ sprinkler components drilled														
			$x = 10$	$x = 20$	$x = 30$	$x = 40$	$x = 50$	$x = 60$	$x = 70$	$x = 80$	$x = 90$	$x = 100$					
A	Y	1000	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75	
B	Y	1200	3.10	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75
C	N	1000	3.30	3.30	3.35	3.40	3.40	3.45	3.45	3.50	3.50	3.55	3.60	3.60	3.65	3.70	3.75
D	N	1400	3.20	3.20	3.25	3.30	3.35	3.35	3.40	3.45	3.45	3.50	3.55	3.60	3.60	3.65	3.70
E	Y	1100	3.20	3.25	3.25	3.30	3.35	3.35	3.40	3.45	3.45	3.50	3.55	3.60	3.60	3.65	3.70
F	N	1200	3.20	3.20	3.30	3.35	3.40	3.40	3.45	3.45	3.50	3.55	3.60	3.65	3.65	3.70	3.75



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## Redesign of the product

You must complete ALL activities.

### Activity 1

At the start of the task create a short outline project time plan in your task booklet.

During the other activities (2 to 5), you should also record **in the Activity 1 section** of your task booklet:

- why changes were made to the design during each session
- action points for the next session.

**(Total for Activity 1 = 6 marks)**

**Suggested time 45 minutes**

### Activity 2

Interpret the client brief into operational requirements, to include:

- product requirements
- opportunities and constraints
- interpretation of numerical data
- key health and safety, regulatory and sustainability factors.

**(Total for Activity 2 = 6 marks)**

**Suggested time 45 minutes**

### Activity 3

Produce a range of (three or four) initial design ideas based on the client brief, to include:

- sketches
- annotations.

**(Total for Activity 3 = 9 marks)**

**Suggested time 1 hour 15 minutes**

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#### Activity 4

Develop a modified product proposal with relevant design documentation.

The proposal **must** include:

- a solution (including a final drawing).

The proposal **must** consider:

- existing products
- materials
- manufacturing processes
- sustainability
- safety
- other relevant factors.

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**(Total for Activity 4 = 30 marks)**

**Suggested time 4 hours**

#### Activity 5

Your final task booklet entry must evaluate:

- success and limitations of the completed solutions
- indirect benefits and opportunities
- constraints
- opportunities for technology-led modifications.

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**(Total for Activity 5 = 9 marks)**

**Suggested time 1 hour 15 minutes**



### Activity 1

At the start of the task create a short outline project time plan in your task booklet.

During the other activities (2 to 5), you should also record **in the Activity 1 section** of your task booklet:

- why changes were made to the design during each session
- action points for the next session.

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**(Total for Activity 1 = 6 marks)**



## Activity 2

Interpret the client brief into operational requirements, to include:

- product requirements
- opportunities and constraints
- interpretation of numerical data
- key health and safety, regulatory and sustainability factors.

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**(Total for Activity 2 = 6 marks)**




### Activity 3

Produce a range of (three or four) initial design ideas based on the client brief, to include:

- sketches
- annotations.

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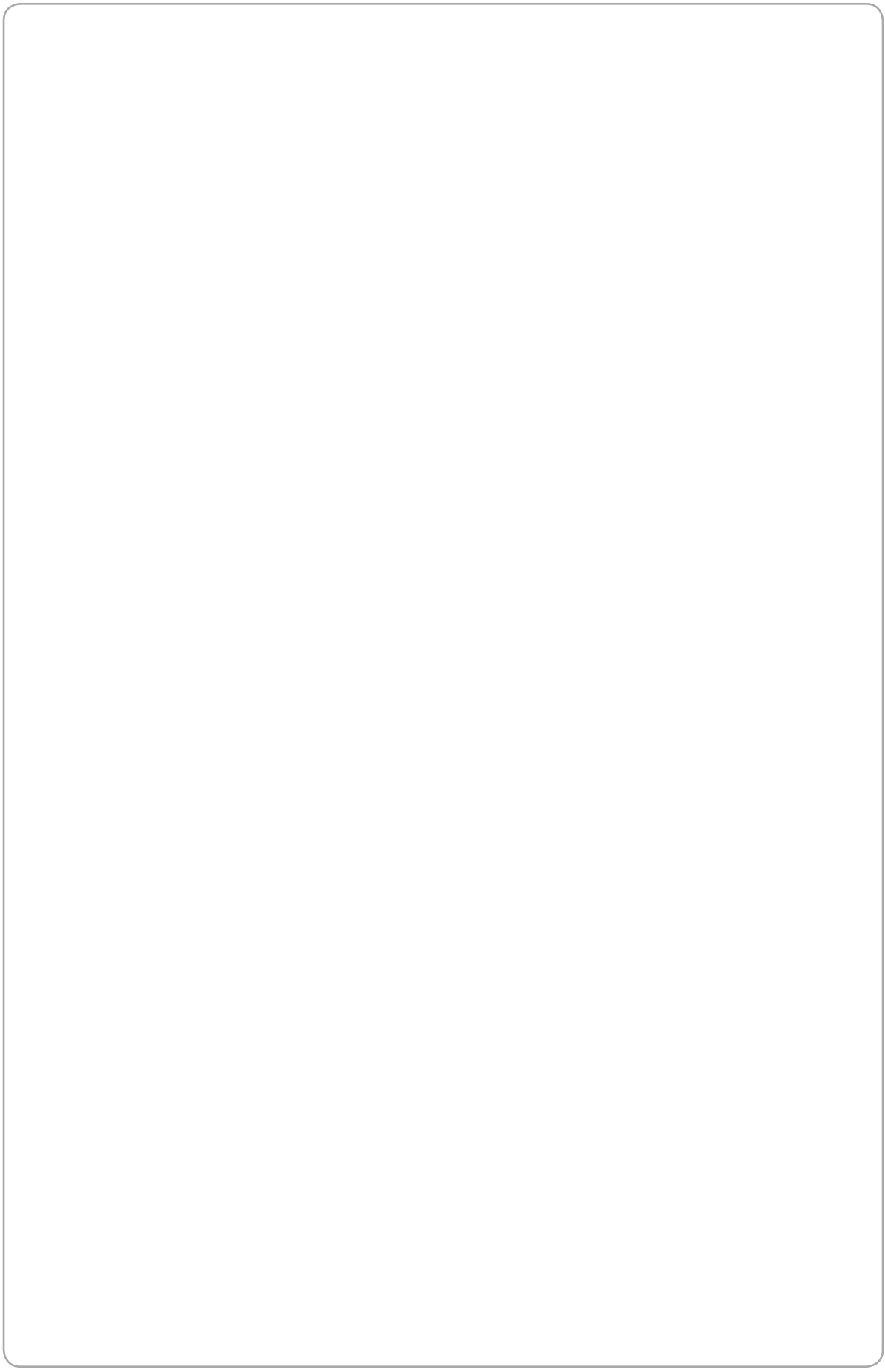
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**(Total for Activity 3 = 9 marks)**



#### Activity 4

Develop a modified product proposal with relevant design documentation.

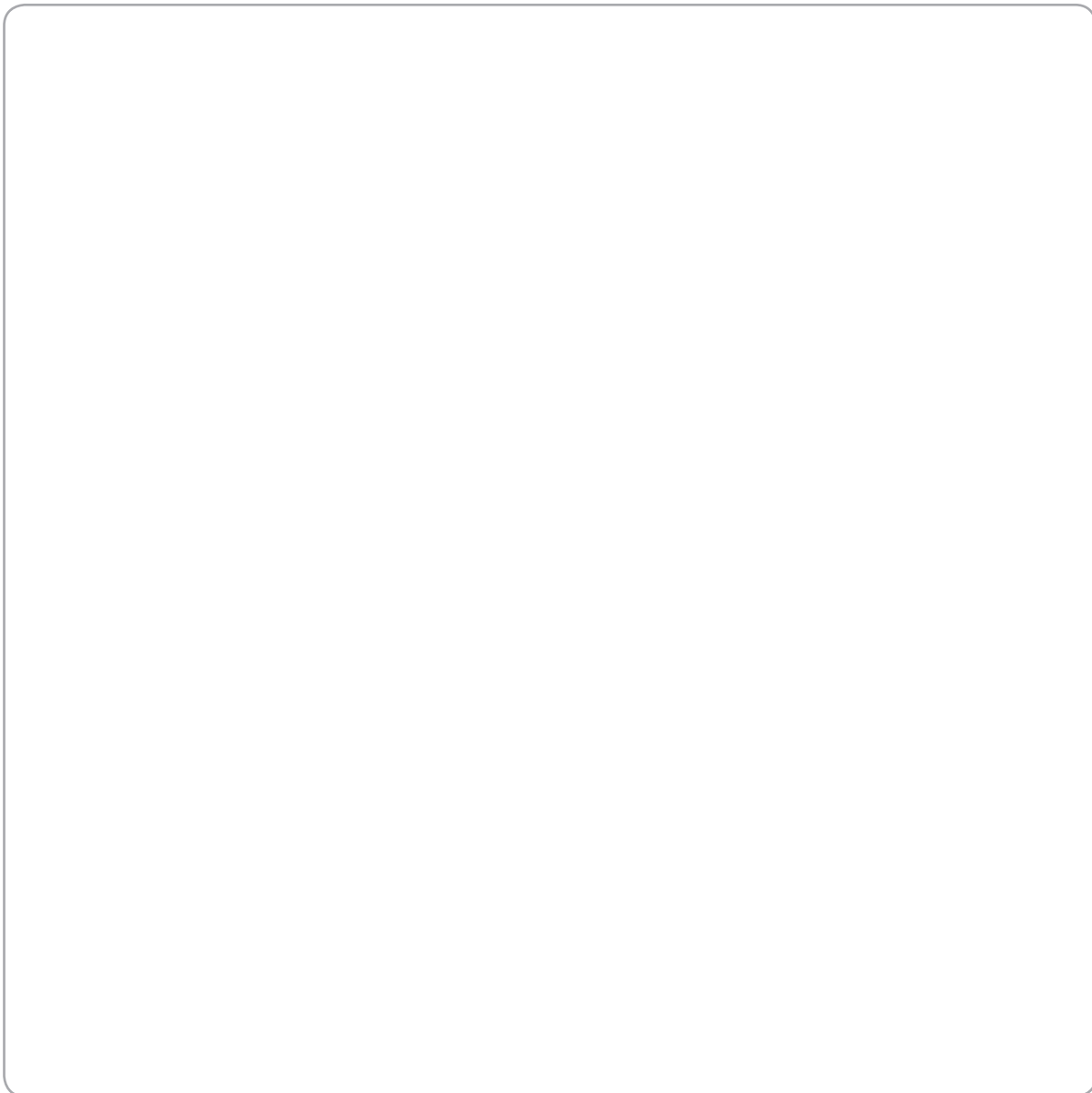
The proposal **must** include:

- a solution (including a final drawing).

The proposal **must** consider:

- existing products
- materials
- manufacturing processes
- sustainability
- safety
- other relevant factors.

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[Large empty rectangular box for writing answers]

**(Total for Activity 4 = 30 marks)**





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**(Total for Activity 5 = 9 marks)**

**TOTAL FOR TASK = 60 MARKS**





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