OCR
Oxford Cambridge and RSA

Awaiting Accreditation

This qualification has not yet been accredited by Ofqual. It is published to enable teachers to have an early sight of our proposed approach to GCSE (9-1) Design and Technology. Further changes may be required and no assurance can be given at this time that the proposed qualification will be made available in its current form, or that it will be accredited in time for first teaching in 2017 and first award in 2019.

GCSE (9–1) Design and Technology

J310/01 Principles of Design and Technology

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 2 hours

You must have:
- the Insert

You may use:
- a scientific calculator
- a ruler
- geometrical instruments

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- The Insert will be found inside this document, it must be used when answering questions in **Section B**.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary, but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

SECTION A

Answer **all** the questions.

1 **Fig.1** shows a child's high chair.

Fig.1

(a) The table below gives three features of the child's high chair.

Complete the table by inserting the term which best describes the most significant influence of each feature. Select a different term for each feature from the list below.

Aesthetics **Ergonomics** **Function** **Sustainability**

Feature	Influence
Folding legs	
Fairtrade cotton (used for straps)	
Padded seat	

[3]

(b) Identify **two** stakeholders, other than a child, that might have been considered when designing the high chair.

1 ……

2 ……**[2]**

(c) Explain how current design trends could influence the design of the child's high chair.

……...

……..

……..…**[2]**

(d) The food tray of the child's high chair is made from a thermo polymer material.

(i) Name a suitable specific thermo polymer that could be used for the food tray.

……..……...**[1]**

(ii) Give **two** properties of thermo polymer materials that make them suitable for the food tray.

1 ……..……..

2 ……..**[2]**

(e) The legs of the high chair are made from mild steel.

Explain **one** reason why mild steel supports the functional performance of the high chair.

……...

……..…..

……..…**[2]**

(f) **(i)** Give **two** pieces of anthropometric data that the designer of the child's high chair would need to know.

1 ……...…….

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2 ……..…….....

……**[2]**

(ii)* Evaluate the importance of using anthropometric data when designing. Refer to products, other than the high chair, that are drawn from your wider experience to support your answer.

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……**[8]**

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Turn over for the next question

2 A manufacturer of fashion accessories is developing a range of handbags.

Fig. 2 shows the design of a handbag.

Fig. 3 shows the front panel of the handbag design.

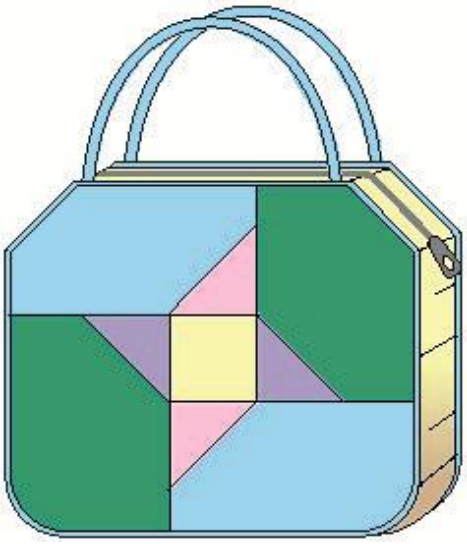


Fig. 2

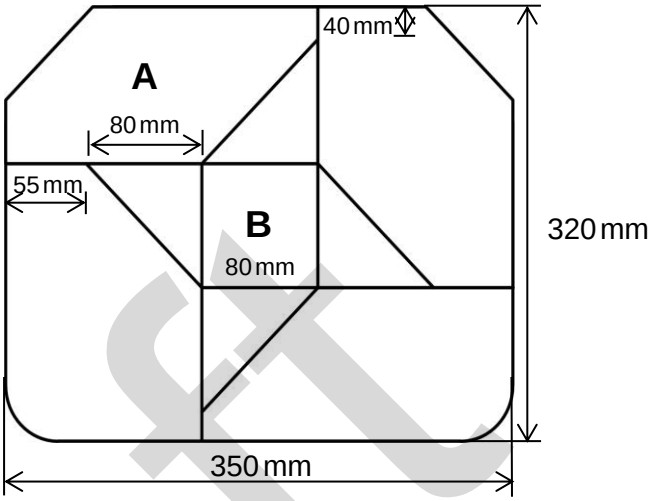
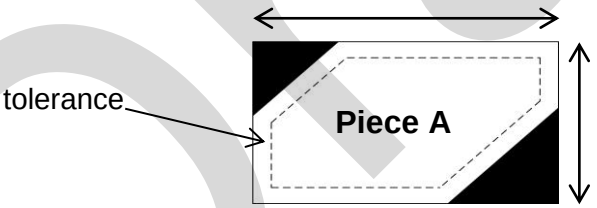


Fig. 3

(a) In **Fig. 3** piece **B** is a square and all four triangular pieces are isosceles triangles.

Piece **A** in **Fig. 3** is cut from a rectangular piece of fabric as shown in **Fig. 4** below.



Not to scale
Fig. 4

(i) Calculate the dimensions of the rectangular piece of fabric needed for Piece **A**. There is a tolerance of 15 mm.

(a)(i) Dimensions = ……mm × ……mm **[3]**

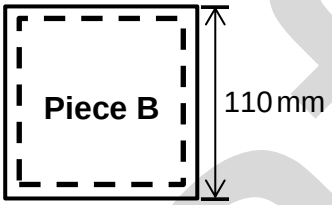
(ii) Piece **A** is to be cut from a width of fabric that is 1320 mm wide.

Calculate the maximum number of pieces that can be cut from one width of fabric, considering tessellation.

(ii) Number of pieces = ... **[2]**

(b) The manufacturer needs to work out the cost of each piece of fabric for the handbag.

Piece **B** in **Fig. 5** is square.



Not to scale
Fig. 5

(i) 12 lots of Piece **B** can be cut from a width of fabric.

Calculate the length of fabric required to cut 180 lots of Piece **B**.
Give your answer in **metres**.

(b)(i) Length of fabric required = ...m **[3]**

(ii) The fabric used for Piece **B** costs £18.95 per metre.

Calculate the cost of **one** Piece **B** using your calculations from part **(b)(i)**.

(ii) Cost of **one** Piece **B =** .....pence **[3]**

(c) The total cost of making one handbag is £28.35. The manufacturer will sell the handbags to retailers at £43.50 each.

Calculate the expected profit for one handbag.

(c) Profit = £…… **[1]**

(d) The designer of the handbag has chosen to re-use materials from old products to make the bag.

Identify **two** considerations when re-using materials and/or system components to make a new product.

1 ……

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2 ……

……**[2]**

(e) Explain **two** benefits to a manufacturer of designing and making products in a way that reduces environmental impact.

1 ……

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2 ……

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……**[4]**

3 **Fig. 6** shows a robotic lawnmower.

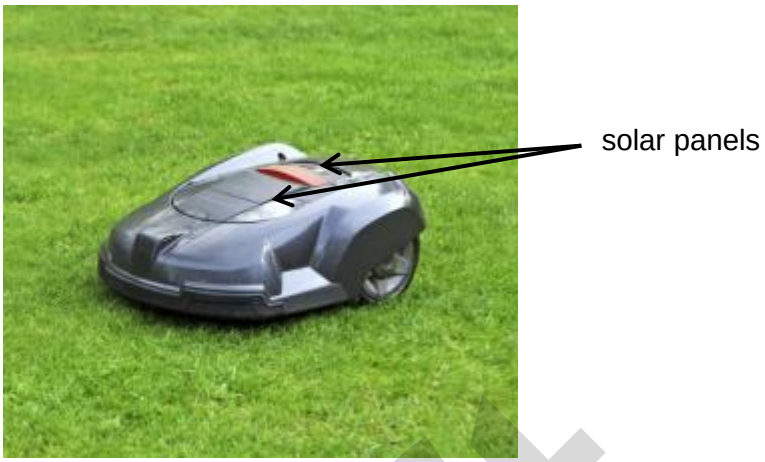

Fig. 6

(a) The lawnmower has a number of inputs and outputs in its circuit that allow it to move around, sensing obstacles in its path.

The table below shows the functions of the robotic lawnmower.

Complete the table with the missing inputs or outputs and electronic components.

Function	**Input or Output**	**Electronic component**
Sensing obstacles	Input	Push to make switch / Infra-red
Sensing the edge of the grass so that it stops	……..	Light Dependent Resistor (LDR)
Moving wheels	Output	Motor
Making a sound when it hits an obstacle	Output	…….
Visual indication that the power level is low	……..	……..
Triggers to mower to switch off if it topples over	Input	Tilt switch

[4]

(b) The robotic lawnmower receives its energy from solar panels.

(i) State the component that would be used to store the solar energy needed to power the lawnmower when it is turned on.

……**[1]**

(ii) Explain **one** advantage and **one** disadvantage of using solar panels to power the robotic lawnmower.

Advantage ...……

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……

Disadvantage ...……

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…...……**[4]**

(c) New and emerging technologies influence the design of many products.

Discuss how new and emerging technologies have been used to improve the function and/or performance of products.

Use examples to support your answer.

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……**[6]**

SECTION B

Answer **all** the questions.

For **all** questions in Section B you **must** refer to the **Insert** which contains images and information about products that you would find in a train station.

4 **(a)** The information leaflets shown in **Image A** are made from paper.

Give **two** reasons why paper is suitable for this product.

1 ……..…….

……...

2 ……..…….

……..**[2]**

(b) The leaflet display in **Image A** uses the polymer acrylic to hold the leaflets in place.

Give **one** benefit of acrylic being used.

…….

……..**[1]**

(c) The women in **Image B** is wearing a red coat made from a natural fibre.

(i) Name a natural fibre.

……..**[1]**

(ii) Explain **one** property of natural fibres that make them suitable for the coat shown.

…….

…….

……**[2]**

(d) **Image C** shows a locking device on a luggage trolley. **Fig. 7** shows how the device works. The £1 coin is inserted into the device. The key is released and pops out.

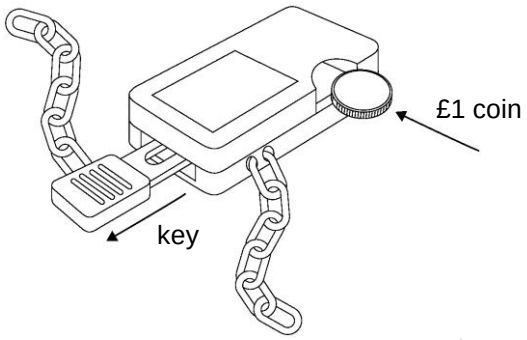

Fig. 7

(i) State the type of force that is required to insert a £1 coin into the locking device.

……..…**[1]**

(ii) State the type of motion that takes place when the key is released from the locking device.

……..…**[1]**

(e) The bench shown in **Image D** has a metal frame and wooden seat and back.

Explain why a hardwood has been used for the seat and back of the bench rather than a softwood.

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……..**[2]**

You need to answer questions **5** and **6** in relation to **one** of the products listed below covering an area you have studied in depth.

Information about the products is contained in the **Insert**.

Before you choose a product, read all parts of questions 5 and 6.

You **must** tick **one** box below to indicate your chosen product.

- ☐ **Product 1:** Information leaflets shown in **Image A** - (papers and boards)
- ☐ **Product 2:** High visibility jacket shown in **Image B** - (fibres and fabrics)
- ☐ **Product 3:** Arrivals/departures board shown in **Image E** - (design engineering)
- ☐ **Product 4:** Retractable tape barrier shown in **Images F and G** - (polymers)
- ☐ **Product 5:** Toilet sign shown in **Image H** - (metals)
- ☐ **Product 6:** Flower planter shown in **Image H** - (timbers)

You should spend approximately 20 minutes on Question 5 (a).

5 Refer to the specific information about your chosen product on page 3 of the Insert to answer this question.

(a) Designers produce prototypes to present their designs to key stakeholders.

Analyse the information given in the Insert for your chosen product. Notes and annotated sketches **must** be used to communicate how a final **prototype** would be made in a school workshop.

You **must** include details of:

- selection of materials and/or components
- consideration of scale and dimensions
- workshop techniques, processes and tools, including software. **[9]**

(b) Designers use different approaches when designing to ensure stakeholder opinions are considered.

(i) Explain **one** approach that might be used to ensure the main stakeholders are given full consideration when designing.

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……**[2]**

(ii) Explain the importance of prototypes in discussions between designers and stakeholders.

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……**[3]**

(c) Your chosen product is to be manufactured to the quantities given on page 3 of the Insert.

(i) State a suitable scale of production for your chosen product to meet this requirement.

……**[1]**

(ii) Explain **one** industrial manufacturing process that is suitable for making the main component of your chosen product to this scale of production.

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……**[2]**

(d) 'Inclusivity is an important consideration in the design of products.'

Discuss the above statement in relation to products and/or systems located in a train station environment; use the images in the Insert to help you.

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……..**[6]**

6 You **must** use the same product you chose for Question 5 to answer this question.

Sourcing, harvesting and processing materials into workable forms can create moral and social issues.

(a) For **one** specific material from your chosen product:

- state the source of the material and
- explain how it is processed into a workable form.

Specific material ……

Source of material ……

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……**[4]**

(b)* Discuss the social and ethical issues that can arise when sourcing and processing materials into workable forms to be used in products and/or systems.

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……**[8]**

END OF QUESTION PAPER

OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

GCSE (9–1) Design and Technology

J310/01 Principles of Design and Technology

SAMPLE MARK SCHEME

Duration: 2 hours

MAXIMUM MARK 100

DRAFT

This document consists of 40 pages

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. **Annotations**

Annotation	Meaning
BP	Blank page
✔	Point where mark is awarded
✘	Incorrect response
L1	Level one response
L2	Level two response
L3	Level three response
ECF	Error carried forward
REP	Repetition
SEEN	Noted, but no credit given
PD	Poor diagram offering unclear response

11. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

LEVELS OF RESPONSE QUESTIONS:
The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of level descriptors best describes the overall quality of the answer. Once the level is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.
Highest mark: If clear evidence of all the qualities in the level descriptors is shown, the HIGHEST mark should be awarded.
Lowest mark: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the levels below and show limited evidence of meeting the criteria of the level in question) the LOWEST mark should be awarded.
Middle mark: This mark should be used for candidates who are secure in the level. They are not 'borderline' but they have only achieved some of the qualities in the level descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) highest level marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the level descriptors, reward appropriately.

The breakdown of Assessment Objectives for GCSE (9–1) Design & Technology

	Assessment Objective
AO3	**Analyse and evaluate –** • **design decisions and outcomes, including for prototypes made by themselves and others** • **wider issues in design and technology**
AO3.1a	Analyse design decisions and outcomes, including for prototypes made by themselves and others
AO3.1b	Evaluate design decisions and outcomes, including for prototypes made by themselves and others
AO3.2a	Analyse wider issues in design and technology
AO3.2b	Evaluate wider issues in design and technology
AO4	**Demonstrate and apply knowledge and understanding of –** • **technical principles** • **design and making principles**
AO4.1a	Demonstrate knowledge of technical principles
AO4.1b	Demonstrate understanding of technical principles
AO4.1c	Apply knowledge and understanding of technical principles
AO4.2a	Demonstrate knowledge of design and making principles
AO4.2b	Demonstrate understanding of design and making principles
AO4.2c	Apply knowledge and understanding of design and making principles

Question			Answer	Marks	Guidance
1	(a)		**One** for each correct answer in this order only: **Influence** Function Sustainability Ergonomics	**3** **AO4 2a**	
1	(b)		**Two** from e.g.: • mother / father / parent / carer / guardian of the child • older sibling of the child • retailers • manufacturer • health and safety regulators. **Award credit for any other appropriate response**	**2** **AO4 2a**	Do **not** accept two references to a child's carer from bullet one. Do **not** accept child or baby.
1	(c)		Up to **two** marks e.g.: The child's high chair is used in people's homes, modern interior design trends (✓) could influence the styles/shape of the high chair. (✓) <u>Other aspects could include:</u> • colour • pattern of fabric • materials used. <u>Other explanations could include:</u> • to match the décor of the room/house • influenced by a new children's film • a social trend (the desire for environmentally friendly products). **Award credit for any other appropriate response**	**2** **AO4 2c**	1 mark for identifying what feature of the child's high chair could be influenced. 1 mark for explaining how this feature could be influenced by a trend. Answers must be **appropriate** for the context in the question: Child's high chair.

Question			Answer	Marks	Guidance
1	(d)	(i)	**One** from: • HDPE • PVC • ABS • LDPE • PP **Award credit for any other appropriate response**	**1** **AO4** **1c**	Answers must be **suitable** for the context in the question: Food tray for child's high chair. Do **not** accept PET, PS, Acrylic as these are not suitable for the food tray.
1	(d)	(ii)	**Two** from: • waterproof / wipe clean • available in bright colours • tough/hardwearing • lightweight • flexible • can be sterilised • easily moulded. **Award credit for any other appropriate response**	**2** **AO4** **1c**	Answers must be **appropriate** for the context in the question: Food tray for child's high chair.
1	(e)		Up to **two** marks e.g.: • good strength to weight ratio (✓) therefore easy to carry around (✓) • strong (✓) enough to hold a child's weight (✓) • durable (✓) making it long lasting/hard wearing (✓) • lightweight (✓) making it easy to carry. (✓) **Award credit for any other appropriate response**	**2** **AO4** **1c**	1 mark for identifying a property of mild steel that supports the functional performance of the high chair. 1 mark for the reason why this feature supports the functional performance of the high chair. Answers must be **appropriate** for the context in the question: functional performance of the child's high chair.
1	(f)	(i)	**Two** from: • average height of a child • average width of a child's hip/buttocks	**2** **AO4**	Answers **must** relate to human measurements.

Question			Answer	Marks	Guidance
			• length of a child's legs • height of the parent • length of child's arm • height of a child's back • buttock to knee length of child. **Award credit for any other appropriate response**	**1c**	Do **not** award for the surrounding environment or the chair itself. Answers must be **appropriate** for the context in the question: Child's high chair.

Question			Answer	Marks	Guidance	
					Content	Levels of response
1	(f)	(ii)*	Answers could include: • provides information about sizes of human measurements that support the development of design solutions/products • covers a range of human sizes allowing the designer to target a range of users or specific users as appropriate (5th/50th/95th percentile) • helps to improve user comfort and ease of use • helps to ensure design solutions/products fulfil user needs so they will be saleable. If anthropometric data is not considered the products may not: • be suitable for the users they are being designed for which may mean the product does not sell or people return the products because they don't fit. Examples used could relate to: • interface between humans and the products/systems they interact with • products that need to be carried by particular parts of the body • garments that cover the body (allowing for movement). **Award credit for any other appropriate response**	**8** **AO3** **4 x 1b** **AO4** **1 x 1a** **1 x 1b** **1 x 2a** **1 x 2b**	Examples of other products can be from any material area and may use examples of both good and bad use / consideration of anthropometrics. The question asks for other products; therefore do not accept a child's highchair as an example to support the candidate's discussion. A candidate operating at Level 3 should be accessing all AO4 marks and at least two of the AO3 marks. They will also be drawing on their wider knowledge of the whole subject. A candidate operating at Level 2 could be accessing marks in a variety of ways. All AO4 marks with limited evaluation (AO3), or a detailed evaluation around one example or only evaluate the positives or negatives. They should be drawing on some of their wider knowledge/experience of the whole subject.	**Level 3 (6–8 marks)** The candidate will demonstrate sound knowledge and understanding of anthropometrics and using data to link the product to the user when designing. They will be able to undertake a thorough evaluation of the importance of using anthropometrics identifying positive and negative implications. Candidates will be drawing on their wider understanding/experience of the whole subject through their exemplification and evaluation. A variety of relevant examples are used to effectively support the discussion. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated with the use of examples. **Level 2 (3–5 marks)** The candidate will demonstrate sound knowledge and understanding of anthropometrics and using data to link the product to the user when designing. There will be a basic attempt to evaluate the importance of using anthropometrics. Evaluations will be one sided, identifying positive or negative implications or limited to

Question			Answer	Marks	Guidance	
					Content	Levels of response
					A candidate operating at Level 1 will be accessing AO4 marks, but no AO3 marks.	evaluating one factor. Candidates could be drawing on some of their wider understanding/experience of the whole subject through their exemplification and evaluation. Some relevant examples are used to support the discussion. There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Maximum of 4 marks if no evaluation evident**. **Level 1 (1–2 marks)** The candidate will show limited knowledge of what anthropometric data is. There will be basic or no reference to understanding of how anthropometric data is important when designing. There is no attempt at evaluation. If examples are used to support the discussion they may not be relevant. The information has some relevance and is presented with limited structure or detail. The information is supported by limited evidence. **Level 0 (0 marks)** No response or no response worthy of credit.

Question			Answer	Marks	Guidance
2	(a)	(i)	80 + 40 and (2 × 80) + 55 (✓) then (2 × 15) for each set of dimensions (✓) then 80 + 40 + (2 × 15) = 150 and (2 × 80) + 55 + (2 × 15) = 245 (✓) **Award credit for any other appropriate method of calculation**	**3** **AO3** **1 x 1a** **AO4** **2 x 1c**	1 mark for analysing the information in Fig. 3 to find the correct information for both dimensions. 1 mark for recognising the addition of tolerance. 1 mark for correct calculations. **Correct answer scores full marks**

Question			Answer	Marks	Guidance
2	(a)	(ii)	1320 ÷ 150* = 8.8 (✓) 8.8 = 8 pieces (✓) **Award credit for any other appropriate method of calculation**	**2** **AO3** **1 x 1b** **AO4** **1 x 1c**	1 mark for dividing the shortest dimension from part (i)*****, following evaluation of the most effective tessellation of Piece A. 1 mark for rounding down to ensure a whole piece is cut. ***Error carried forward from 2 (a)(i)** **Correct answer scores full marks**

2	**(b)**	**(i)**	180 ÷ 12 = 15 (✓) then 15 × 110 = 1650 mm (✓) then 1650 ÷ 100 = 1.65 m (✓) **Award credit for any other appropriate method of calculation**	**3** **AO4 1c**	1 mark for dividing the number of pieces required by the number of pieces that it into a width of fabric. 1 mark for multiplying the size of the Piece B by the number of repeats required. 1 mark for converting mm to m. **Correct answer scores full marks**

Question			Answer	Marks	Guidance
2	(b)	(ii)	18.95 × 1.65* = £31.27 (✓) then (£31.27 ÷ 15) (✓) ÷ 12 = 17p (✓) **Award credit for any other appropriate method of calculation**	**3** **AO4 1c**	1 mark for calculating the cost of 1.65m***** of fabric. 1 mark for dividing down to get one strip of fabric. 1 mark for dividing down to get an individual piece from the strip. ***Error carried forward from 2(b)(i)** **Correct answer scores full marks**
2	(c)		£43.50 - £28.35 = £15.15 (✓)	**1** **AO4 1c**	**Correct answer scores full marks**
2	(d)		**Two** from e.g.: • materials will need to be free from damage • materials will need to be thoroughly cleaned • materials are not irreversible soiled/stained • material is of an acceptable quality • components will need to be cleaned up before re-applying them • components on a board may need to be replaced due to defects • components will have to be tested to see if they are still effective • designer will have to find a reliable source. **Award credit for any other appropriate response**	**2** **AO4 1b**	1 mark for each valid point made.

Question			Answer	Marks	Guidance
2	(e)		Up to **two** marks for each benefit explained e.g.: • delivering products that reduce environmental impact is good for PR / publicity (✓), as it promotes a good image (✓) for the manufacturer • it helps to conserve resources (✓), so that the manufacturer can show that their output reduces (✓) environmental impact. Other benefits to the manufacturer could include: • meeting customers' environmental standards • design for easier / cleaner disposal of materials at the end of life • less harmful waste. Explanations could be in the form of: • results in higher sales • reduced carbon footprint / CO_2 • receive tax incentives / grants. **Award credit for any other appropriate response**	**4** **AO4 1b**	1 mark for each benefit. 1 mark for justified explanation.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>One mark for each statement in the table:

<table>
<tr><th>Function</th><th>Input or Output</th><th>Electronic component</th></tr>
<tr><td>Sensing obstacles</td><td>Input</td><td>Push to make switch / Infra-red</td></tr>
<tr><td>Sensing the edge of the grass so that it stops</td><td>Input (✓)</td><td>Light Dependent Resistor (LDR)</td></tr>
<tr><td>Moving wheels</td><td>Output</td><td>Motor</td></tr>
<tr><td>Making a sound when it hits an obstacle</td><td>Output</td><td>Piezo/Buzzer/Speaker /Bell/Siren (✓)</td></tr>
<tr><td>Visual indication that the batteries are low</td><td>Output (✓)</td><td>Light emitting diode/LED/Liquid crystal display/LCD (✓)</td></tr>
<tr><td>Triggers to mower to switch off if it topples over</td><td>Input</td><td>Tilt switch</td></tr>
</table></td><td>4

AO4
3 x 1a

AO4
1 x 1b</td><td></td></tr>
<tr><td>3</td><td>(b)</td><td>(i)</td><td>One from:

• battery
• battery unit
• rechargeable battery.

Award credit for any other appropriate response</td><td>1

AO4
1a</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
3	(b)	(ii)	Up to **two** marks for an advantage explained. **Advantage** e.g. The lawnmower will be cheaper to run (✓) than using mains electricity as solar energy uses the energy from the sun which is free (✓). Other advantages could include: • indefinitely renewable therefore better for the environment • sustainable environmentally as it doesn't generate waste. Up to **two** marks for a disadvantage explained. **Disadvantage** e.g. Solar power relies on there being enough sunlight to charge the lawnmower batteries (✓) in the UK we do not have many sunny days which means the lawnmower may not be charged and ready to use. (✓) Other disadvantages could include: • panels sold at a premium therefore more limited market • not enough energy to power products indefinitely, still need mains. **Award credit for any other appropriate response**	**4** **AO3** **2 x 2a** **AO4** **2 x 1c**	1 mark for an advantage. 1 mark for the justified explanation. 1 mark for a disadvantage. 1 mark for the justified explanation.

Question			Answer	Marks	Guidance	
					Content	Levels of response
3	(c)		Discussion should include knowledge and understanding of the impact of new and emerging technologies when developing design solutions in relation to how they improve the function and performance of new products. Examples of emerging technologies could include: • Nano technologies – medicines • Stem cell technology – genetics • Fuel cell technology – electric vehicles • Artificial intelligence – robots • Quantum Tunnelling Composites (QTC) – Membrane switches, pressure sensors • Piezo electric materials – microphones, headphones • Smart coatings – self-cleaning glass • Smart grease – volume knobs, watch mechanisms • Photochromic materials – react-a-light glasses. **Award credit for any other appropriate response**	**6** **AO3** **1 x 1a** **1 x 1b** **AO4** **4 x 1c**	Candidates should be drawing on example to support their answer. If no examples are used they should not be rewarded with marks higher than a Level 1. A candidate operating at Level 3 should be accessing all AO4 marks and at least one of the AO3 marks, relating to new technologies influence on both function and performance of products. A candidate operating at Level 2 could be accessing marks in a variety of ways. All/most AO4 marks with limited analysis or evaluation (AO3), or a clear analysis and evaluation around an example that is more likely to focus on influences on either function or performance. A candidate operating at Level 1 will be accessing AO4 marks, but no AO3 marks.	**Level 3 (5–6 marks)** The candidate will demonstrate an excellent understanding of new and emerging technologies. They will be able to discuss this convincingly, using examples of products to analyse and/or evaluate the influence of new technologies on the function and performance of the products. **Level 2 (3–4 marks)** The candidate will demonstrate some understanding of new and emerging technologies. They will be able to discuss this, using examples of products to analyse or evaluate the influence of new technologies on the function and/or performance of the products. **Level 1 (1–2 marks)** The candidate will give a basic answer showing limited understanding of how developments in new and emerging technologies have been used to improve the function or performance of new products. Any examples given may not be appropriate. Any attempt at analysis or evaluation will not be worthy of credit. **Level 0 (0 marks)** No response or no response worthy of credit.

Question			Answer	Marks	Guidance
4	(a)		**Two** from e.g.: • it is easy to print on • it is inexpensive • it is easy to recycle when thrown away. **Award credit for any other appropriate response**	**2** **AO4 1c**	Answers must be **appropriate** for the context in the question: Information leaflet in image A.
4	(b)		**One** from e.g.: • it is clear so it is easy to see the leaflets on display. • it is a rigid polymer so good for retaining the leaflets. • it is hygienic and easily cleaned. **Award credit for any other appropriate response**	**1** **AO4 1c**	Answers must be **appropriate** for the context in the question: Leaflet display in image A.
4	(c)	(i)	**One** from e.g.: • wool • silk • cotton **Award credit for any other appropriate response**	**1** **AO4 1a**	**Do not accept:** • mixed-fibres such as cotton/polyester.

Question			Answer	Marks	Guidance
4	(c)	(ii)	Up to **two** marks e.g. Natural fibres have good thermal properties (✓), as the coat is worn outside this will offer warmth to the wearer. (✓) Natural fibres offer good tensile strength (✓), so the coat will last and wear well over time. (✓) Other properties of natural fibres might include: • good absorbency (for dying them) • soft to the touch (for comfortable wear). **Award credit for any other appropriate response**	**2** **AO4 1c**	1 mark for identifying a **suitable** property for the coat. 1 mark for explaining why the property is **suitable** for the coat. The property given may be appropriate, but if the explanation is not appropriate only one mark can be awarded. Answers must be **appropriate** for the context in the question: coat in image B.
4	(d)	(i)	**One** from: • effort • push • pressure.	**1** **AO4 1a**	**Do not accept:** applied force pull
4	(d)	(ii)	Linear	**1** **AO4 1a**	

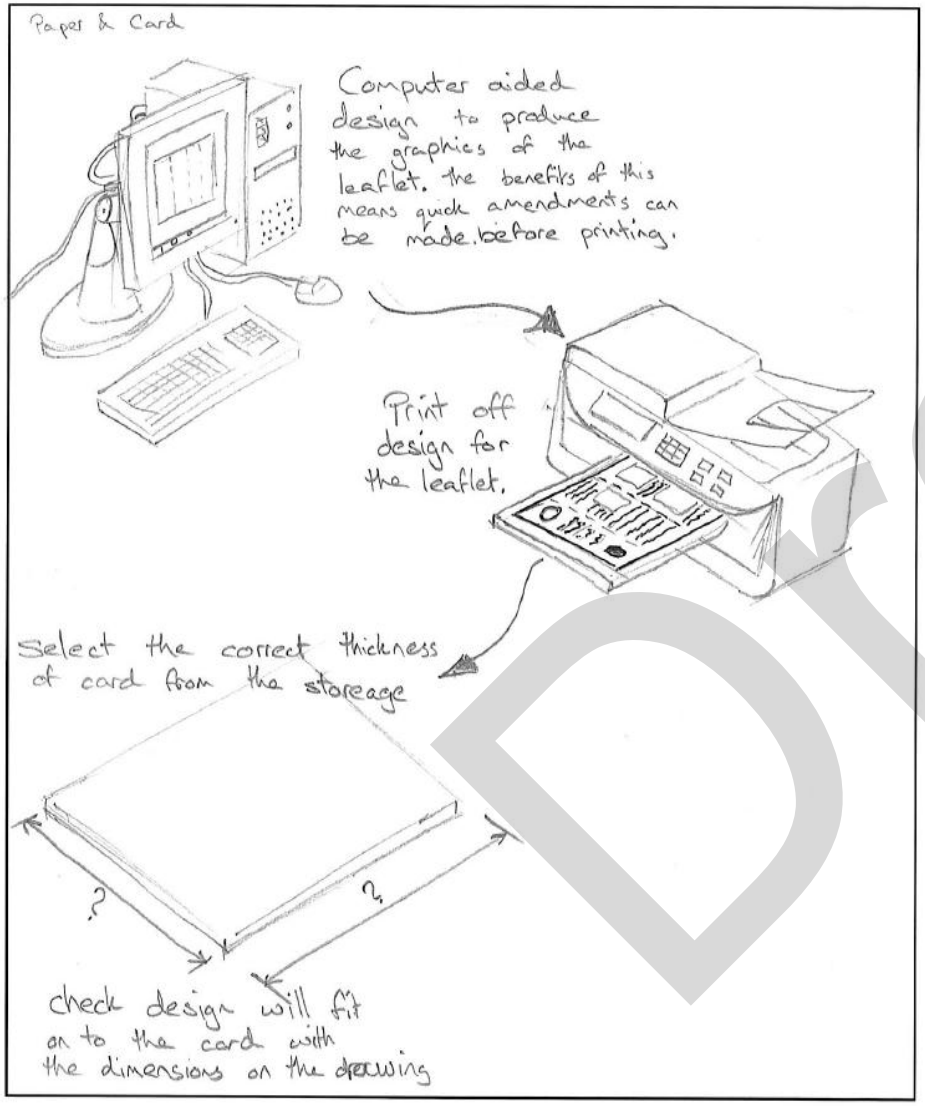
Question			Answer	Marks	Guidance
4	(e)		Up to **two** marks for an explanation e.g. The bench is outdoors and hardwoods are generally better in outside weather conditions (✓), as softwoods generally need more treatment (✓) Other considerations might include: • softwoods generally need to be moved inside when the weather is wet • hardwoods generally more durable over a longer period of time • hardwoods generally much stronger when working with them • will drill well and hold the metal fixings onto the bench • generally less movement in different weather conditions • close grains of hardwood add compression strength in an open slat application. **Award credit for any other appropriate response**	**2** **AO4 1c**	1 mark for an explanation of why a hardwood is **appropriate** for the bench. 1 mark for a comparison to softwood. **Do not accept** hardwood is harder than softwood. Answers must be **appropriate** for the context in the question: Bench in image D.

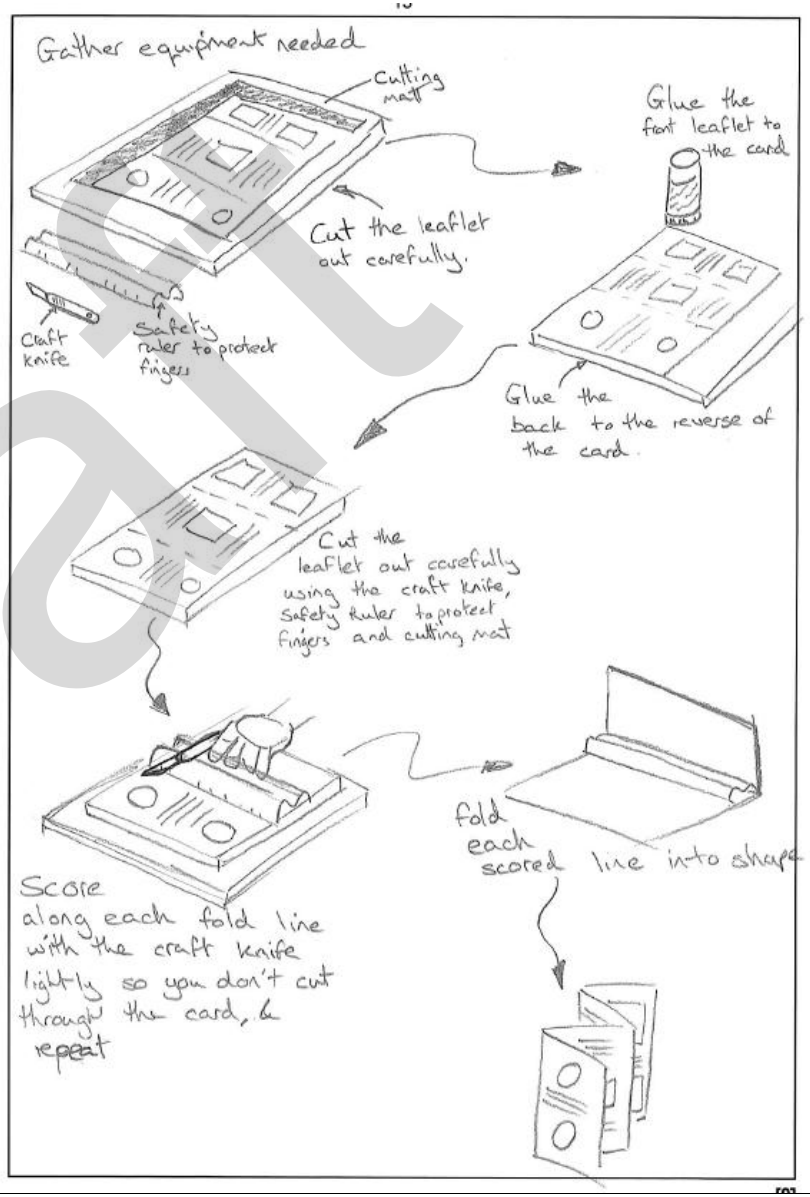
Question			Answer	Marks	Guidance	
					Content	Levels of response
5	(a)		An answer should include: • appropriate selection of materials and/or components • consideration of scale and dimensions • workshop techniques, processes and tools • notes and annotated sketches describing the workshop processes • analysis of given information. Maths skills demonstrated could include but are not limited to: • understanding standard application of metric units used • understanding use of ratios to calculate the scaling of drawings • present accurate 2D or 3D graphics to communicate • interpret and extract appropriate data from technical and graphical sources. Techniques and process should be appropriate to the level of prototype and the materials suggested for use. They can refer to manual, machine or CAD/CAM processes, but they must be appropriate for the workshop not industrial manufacture.	**9** **AO3** **2 x 1a** **AO4** **4 x 1c** **3 x 2c**	Candidates are all required to use notes and sketches in their response. Any response not using sketches or supporting these with annotated notes should not be rewarded with marks higher than Level 1. A candidate operating at Level 3 could be accessing marks in a variety of ways. All AO4 marks and at least one of the AO3 marks for analysing the information from the insert, or all AO3 marks and one mark missing from AO4 for the quality of the sketches clearly communicate making requirements. A candidate operating at Level 2 could be accessing marks in a variety of ways. All AO4 marks with no analysis of the information given on the insert (AO3), or a clear analysis of the information, but not enough sketching and annotated notes to sufficiently demonstrate their knowledge and	**Level 3 (7–9 marks)** The candidate will demonstrate an excellent understanding of the workshop techniques and processes required to make their chosen product as a prototype in a school workshop. Fully appropriate specific materials/components will have been identified. They will have delivered annotated sketches that clearly present the making requirements to a third party, these demonstrate a competent understanding of any required scaling and application of dimensions that show the candidate has fully analysed the information given on the insert. The response will demonstrate the competence of the candidate in drawing on their own workshop experiences and knowledge of tools and processes to fully support their response. The candidate will demonstrate competent use of mathematical skills. **Level 2 (4–6 marks)** The candidate will demonstrate an adequate understanding of the workshop techniques and processes required to make their chosen product as a prototype in a school workshop. Appropriate specific materials/components will

Question			Answer	Marks	Guidance	
					Content	Levels of response
			Materials / components could include: <u>Information leaflets</u> • 130-170 (gsm) gloss paper <u>High visibility jacket</u> • fluorescent polyester and acrylic mixed fabric • reflective strips/tape <u>Arrivals/departures board</u> • ABS • Reference to electronic circuits <u>Retractable tape barrier</u> • ABS • HIPS <u>Toilet signage</u> • Aluminium <u>Flower planter</u> • Pine • Fir See below for indicative drawn responses. **Award credit for any other appropriate response**		understanding of their workshop skills. A candidate operating at Level 1 could be accessing marks in a variety of ways. They have not undertaken any analysis of the information on the insert (AO3) but demonstrate some understanding of the materials and/or processes used to make a prototype(s), or they have done some analysis of the information (AO3) and produced some sketches of merit, but have not demonstrated any knowledge of the materials or making processes.	have been identified. They will have delivered annotated sketches that adequately present the making requirements to a third party, these demonstrate an adequate understanding of any required scaling or application of dimensions that show the candidate has adequately analysed the information given on the insert. The response will demonstrate adequate levels of skills and knowledge of the candidate in drawing on their own workshop experiences and knowledge of tools and processes to offer some support to their response. The candidate will demonstrate adequate use of mathematical skills. **Level 1 (1–3 marks)** The candidate will demonstrate a limited understanding of the workshop techniques and/or processes required to make their chosen product as a prototype in a workshop. Identified materials/components may not be fully appropriate. They may have delivered annotated sketches that do not fully present the making requirements to a third party, demonstrating limited/no understanding of any required scaling or application of dimensions, showing the candidate has not fully analysed the information given in the Insert.

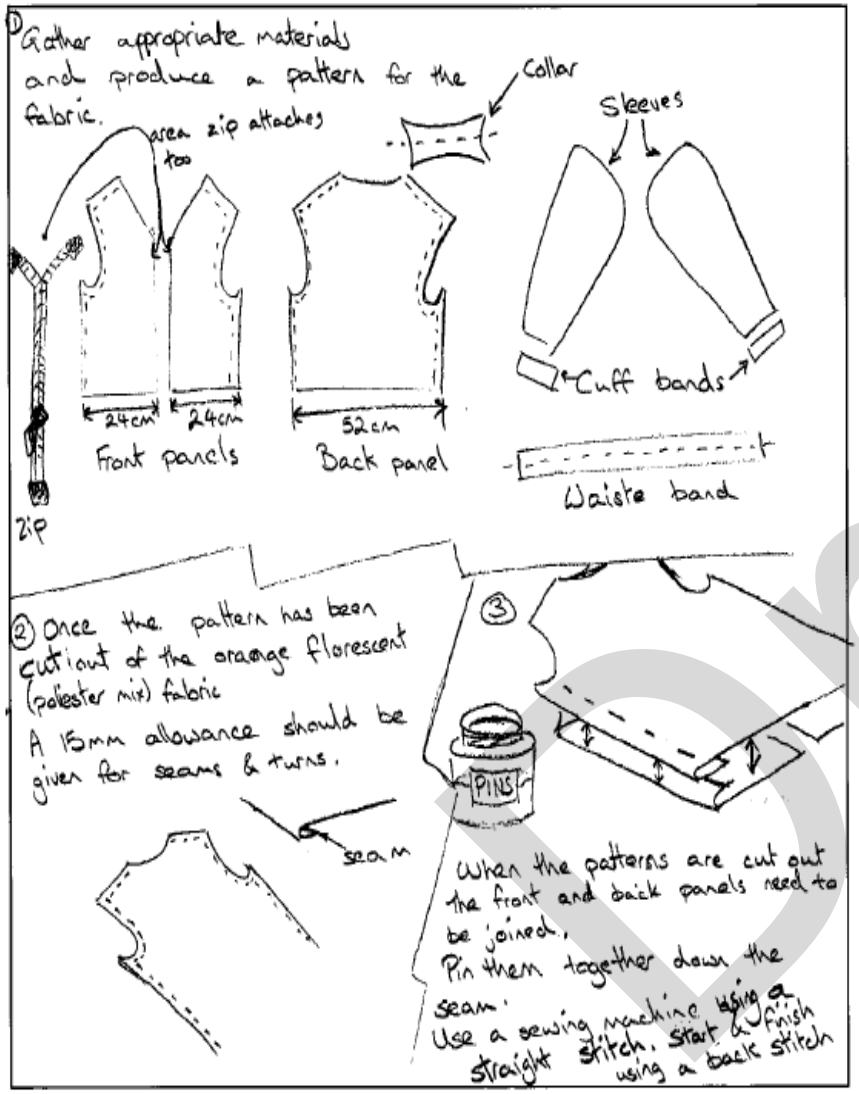
Question			Answer	Marks	Guidance	
					Content	Levels of response
						The response will demonstrate the basic levels of skills and/or knowledge of the candidate in relation to their own workshop experiences and knowledge of tools and processes to offer little / no support to their response. The candidate will demonstrate limited use of mathematical skills. **Level 0 (0 marks)** No response or no response worthy of credit.

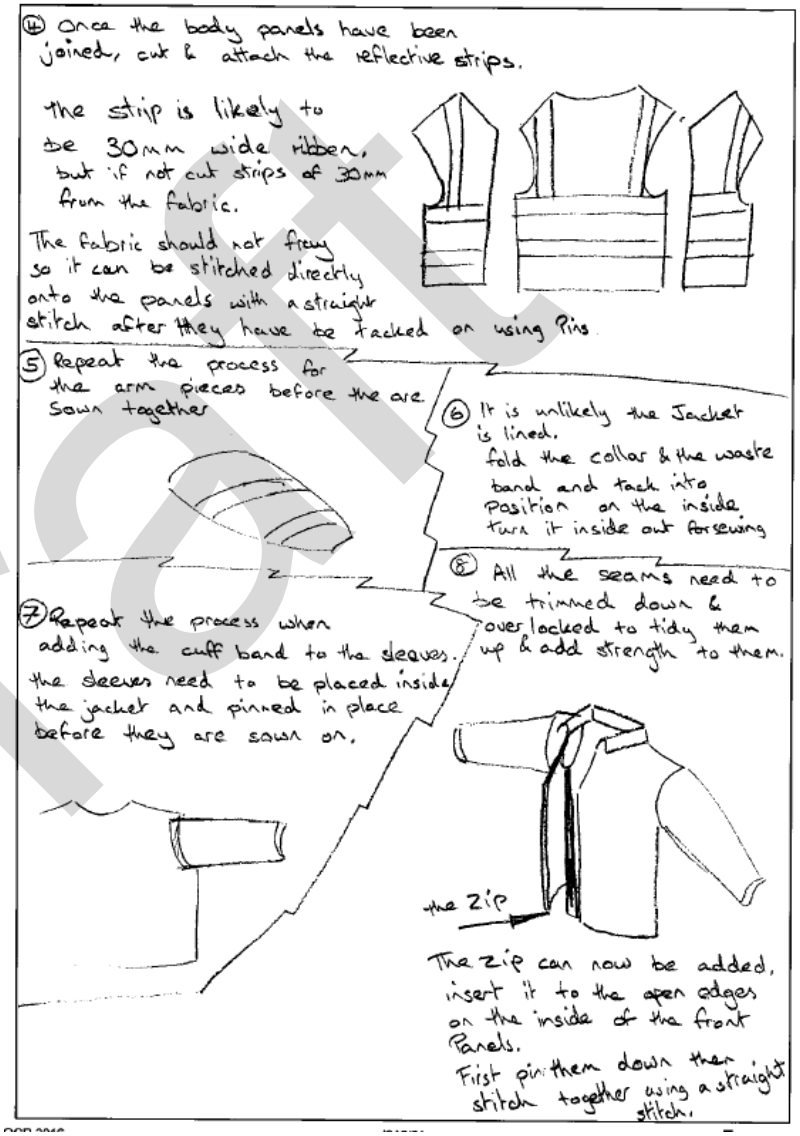
Information leaflets - Indicative drawn responses



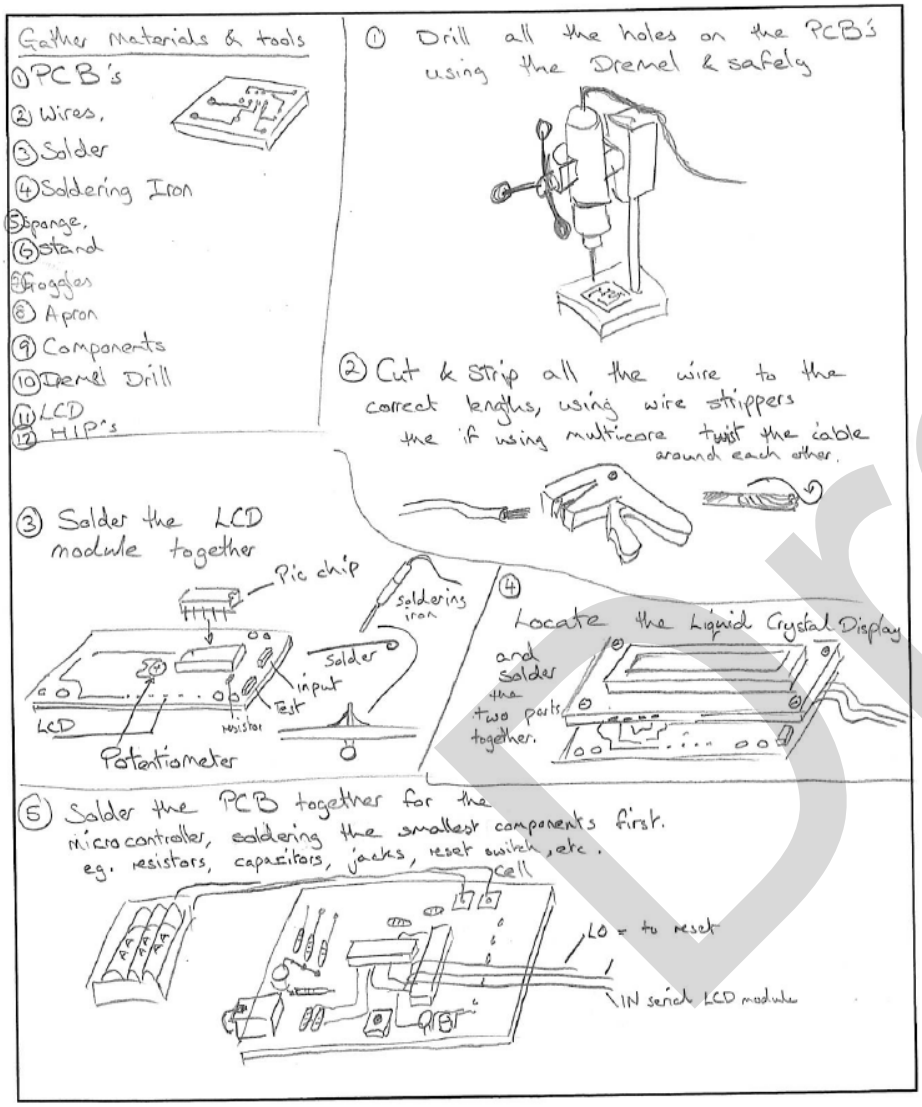


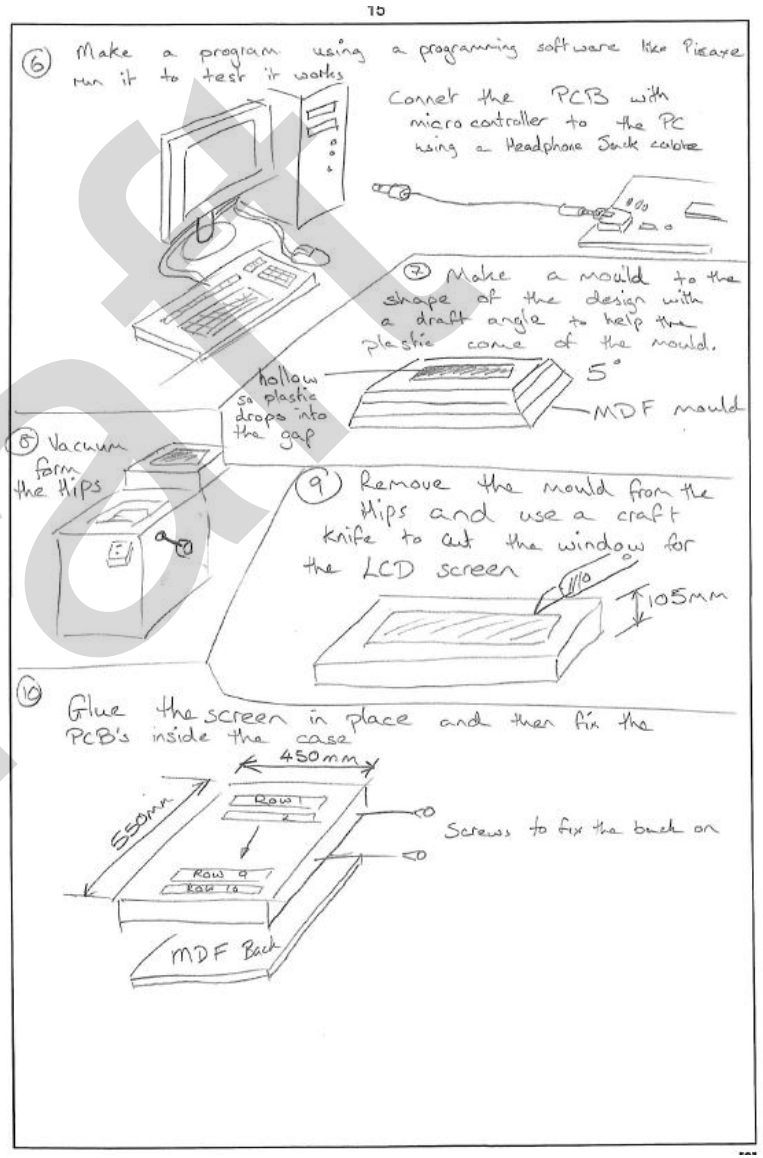
High visibility jacket - Indicative drawn responses



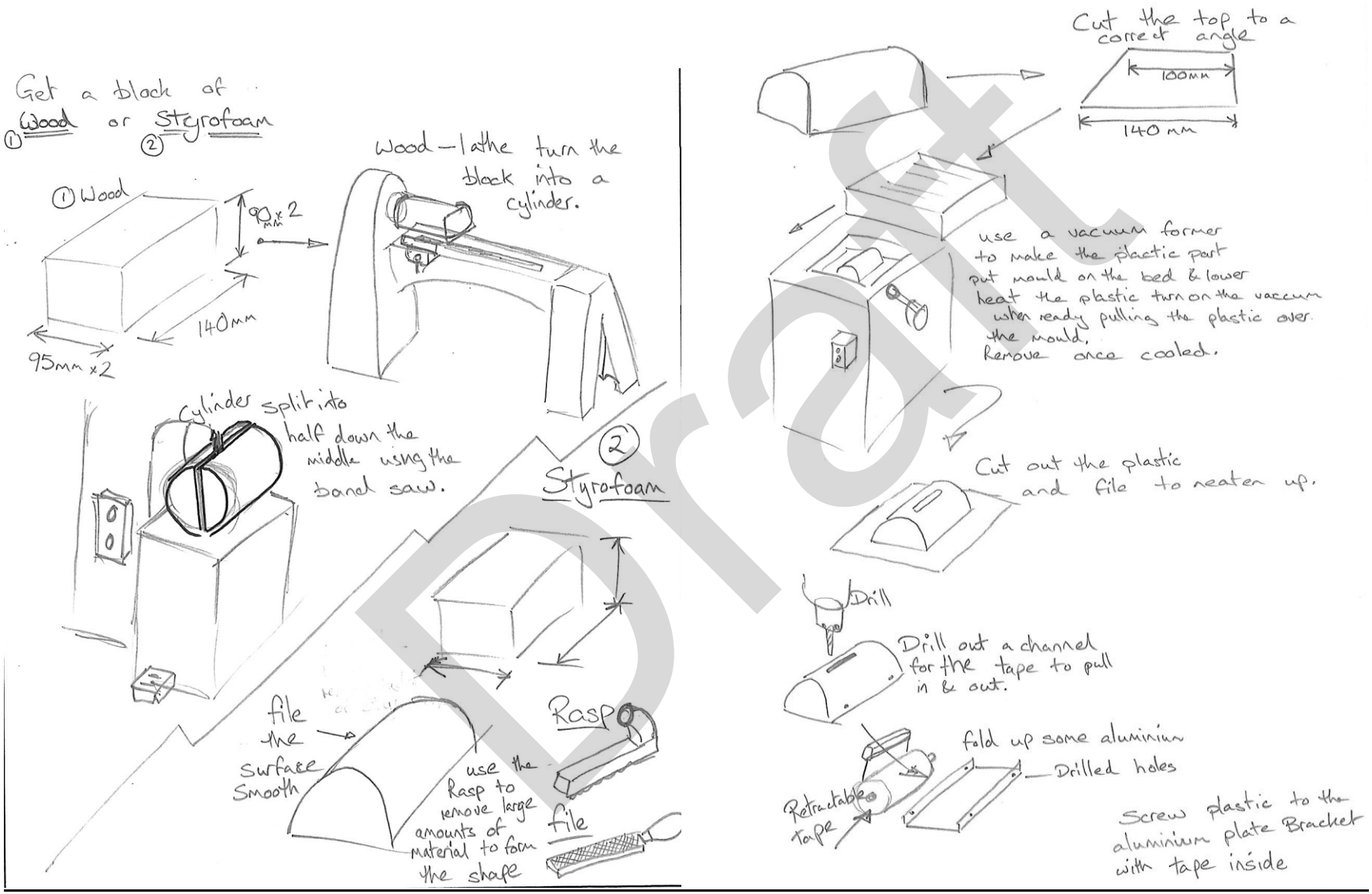


Arrivals/departures board - Indicative drawn responses

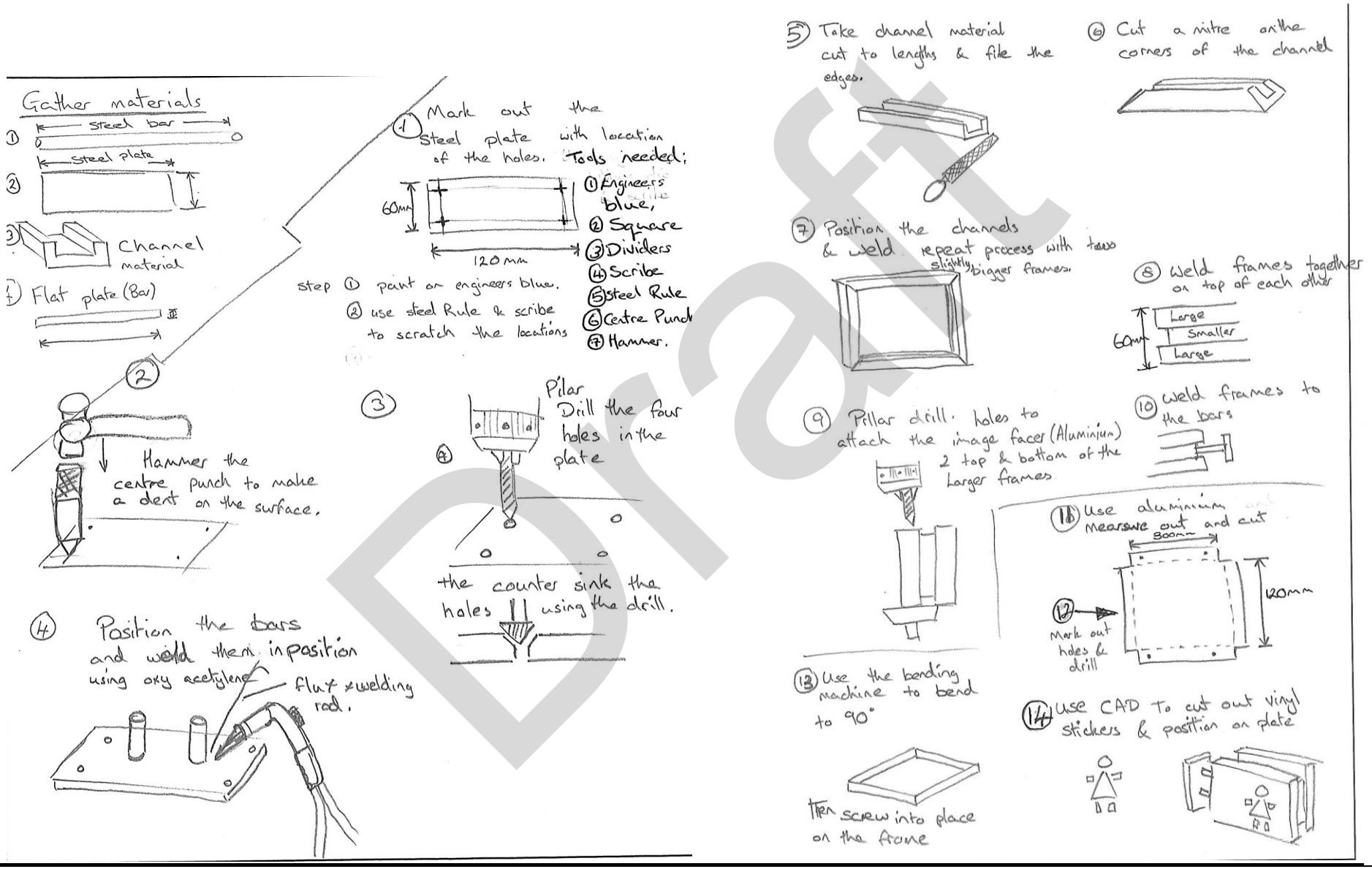




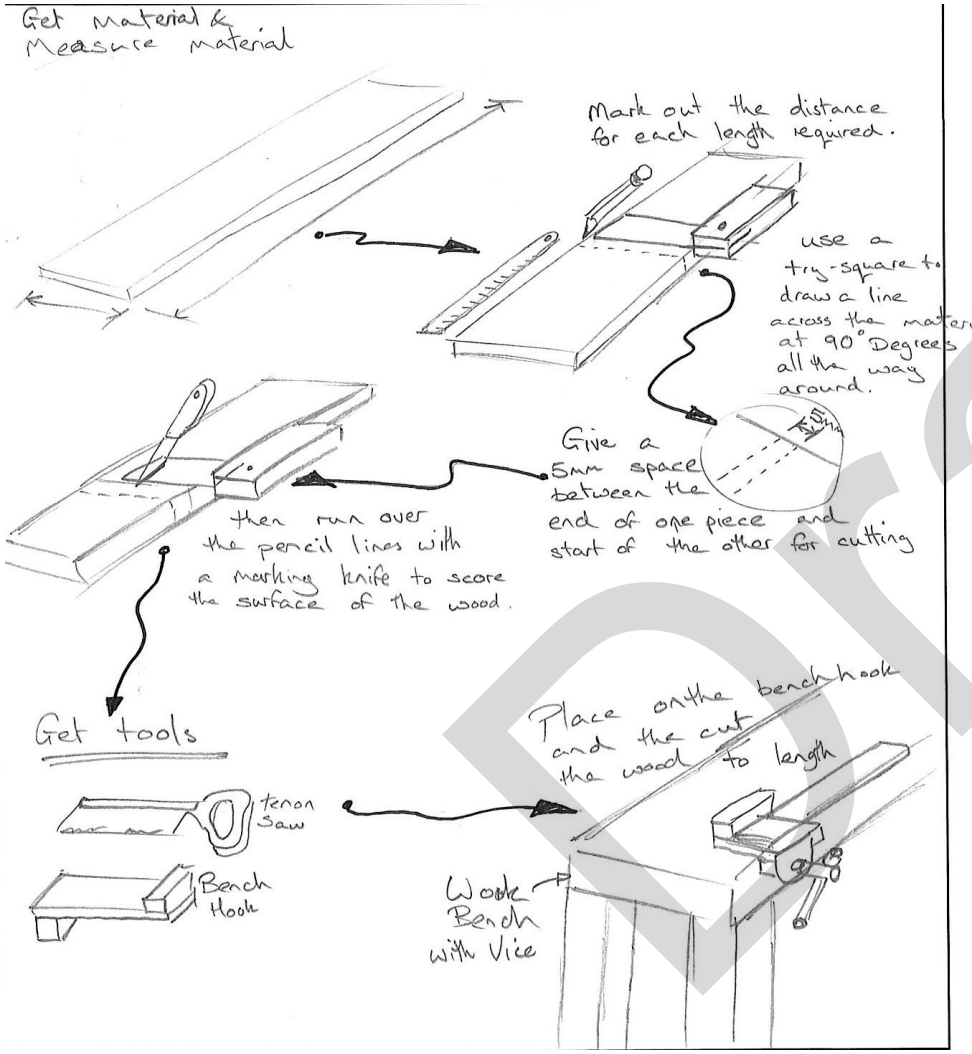
Retractable tape barrier - Indicative drawn responses

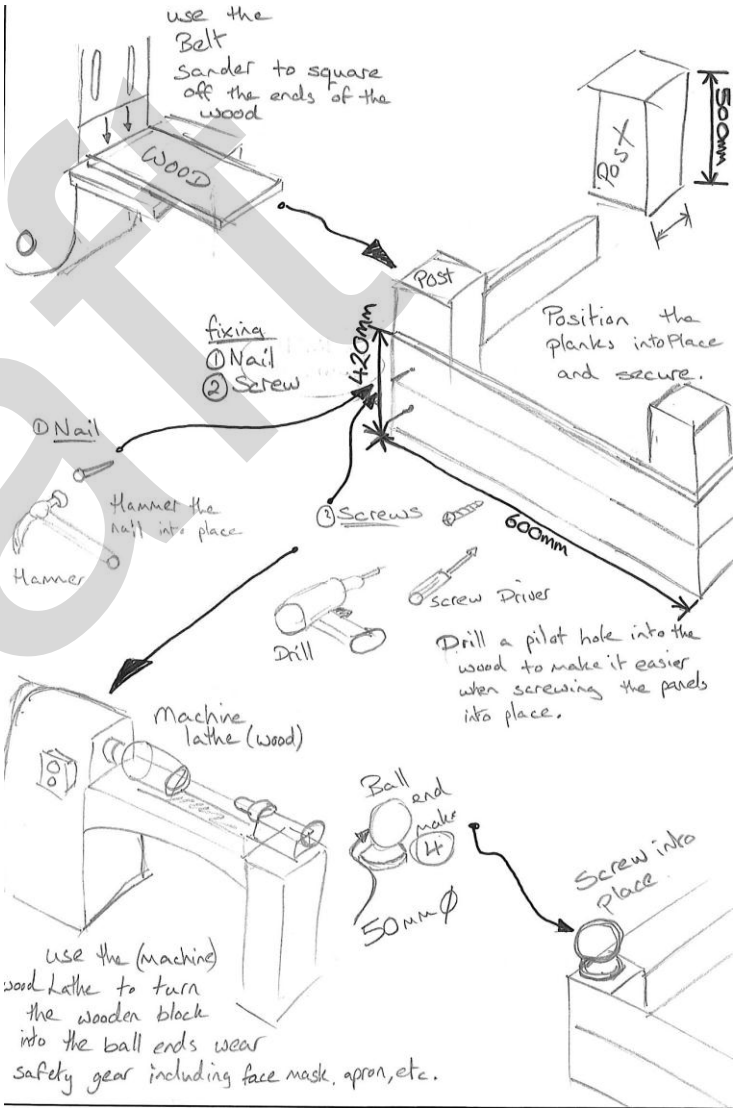


Toilet signage - Indicative drawn responses



Flower planter - Indicative drawn responses





Award credit for any other appropriate response

Question			Answer	Marks	Guidance
5	(b)	(i)	Up to **two** marks for an explanation e.g. User-centred design (✓) puts the user at the middle of the design process through explorations, discussions and collaboration (✓) so they are given full consideration during the development of a product. **Award credit for any other appropriate response**	**2** **AO4** **1 x 2a** **1 x 2b**	1 mark for identifying a suitable approach. 1 mark for an explanation of the intentions of the method.
5	(b)	(ii)	Up to **three** marks for an explanation e.g. Presenting prototypes to stakeholders allows for collaboration and gives the designer more feedback to support future iterations of their designs (✓), stakeholders may identify problems that the designer hadn't thought of themselves (✓), this ensures that the product is more likely to be sold (✓). Other stakeholder feedback of prototypes could include: • suggesting ways of marketing the product • identifying a unique selling point • identifying inaccuracies • obtaining reassurance that the design idea is viable. Other explanation of the importance could be: • ensuring the product is going to fulfil functional requirements • ensuring the product visually appeals to stakeholders. **Award credit for any other appropriate response**	**3** **AO4 2b**	Up to 2 marks for demonstrating their understanding of types of feedback stakeholders can offer. 1 mark for explaining why these are important.

Question			Answer	Marks	Guidance
5	(c)	(i)	In relation to the candidates chosen product. **One** from: • batch • just-in-time.	1 AO4 1c	**Do not accept:** Bespoke, mass production or one-off production these would not be appropriate for any of the products.

Question			Answer	Marks	Guidance
5	(c)	(ii)	In relation to the candidates chosen product. Up to **two** marks for an explanation e.g. Injection moulding (✓) would be appropriate for the retractable tape barrier as the moulds could be used repeatedly (✓) for mass manufacture. Example(s) of industrial manufacturing processes could include: <u>Information leaflets</u> • offset lithography <u>High visibility jacket</u> • industrial sewing machines and overlockers <u>Arrivals/departures board</u> • pick and place robots <u>Retractable tape barrier</u> • injection moulding <u>Toilet signage</u> • powder coating the metal • CNC pressing and stamping <u>Flower planter</u> • CNC lathe • sawing machines **Award credit for any other appropriate response**	**2** **AO4 1c**	Answers must be **appropriate** for the candidates chosen product **and** scale of production given in **5 c(i)**. 1 mark for identifying an **appropriate** process to the scale of production. 1 mark for an explanation of why that process is **appropriate** to the product concerned.

Question			Answer	Marks	Guidance	
					Content	Levels of response
5	(d)		Inclusive considerations could cover: • height of information so people in wheelchairs are able to see things • size of text on displays and information so that they're easier to read by people with problems with their sight • lifts instead of stairs for people with movement disabilities • changing the trolley lock so that less effort is required to use it for people with arthritis • different coloured visibility jackets for staff who are there to help people with disabilities or the elderly so that they are easily identifiable • push buttons for opening doors • use of symbols / language • thinking about children. **Award credit for any other appropriate response**	**6** **AO3** **2 x 1a** **2 x 2b** **AO4** **2 x 1c**	Candidates are all required to use appropriate information from the insert to support their response. All responses should be in context to the train station. *A candidate operating at Level 3 should be accessing both AO4 marks, and at least three of the AO3 marks.* *A candidate operating at Level 2 could be accessing marks in a variety of ways. All AO4 marks with limited analysis or evaluation (AO3), or one AO4 mark supported by two AO3 marks.* *A candidate operating at Level 1 will be accessing at least one AO4 mark, but may access one AO3 mark.*	**Level 3 (5–6 marks)** The candidate will demonstrate good knowledge and understanding of inclusivity demonstrating an understanding of different groups of users e.g. disabled, the elderly or visually impaired. There will be able to demonstrate good analysis of products in the train station, and should have used this analysis to evaluate the importance of inclusivity when designing products. **Level 2 (3–4 marks)** The candidate will demonstrate good knowledge and understanding of inclusivity, this understanding may be limited to one group of users. There will be able to demonstrate some analysis of products in the train station, and may have used this analysis to evaluate the importance of inclusivity when designing products. **Level 1 (1–2 marks)** The candidate will demonstrate limited knowledge and understanding of inclusivity in relation to train station products, and may have made an attempt to analyse a product(s) in the train station. **Level 0 (0 marks)** No response or no response worthy of credit.

Question			Answer	Marks	Guidance
6	(a)		Up to **four** marks for an explanation. In relation to the specific material stated. Answers could answers include: <u>Paper and boards e.g.</u> Paper comes from trees (✓), they are felled and chopped up into pulp with water (✓) The pulp is put into a water-trough where a mesh will be used to collect it (✓). This is then pressed to extract the water and dried to make paper (✓). <u>Natural and manmade timbers</u> Sourced from tress (✓) and a description of the conversion to workable materials. (✓)(✓)(✓) <u>Ferrous and non-ferrous metals</u> Sourced from metal ores such as bauxite, gold and iron ore (✓), and converted through mining and its conversion to workable material. (✓)(✓)(✓) <u>Thermo and thermosetting polymers</u> Sourced from oils (✓) and a description of the conversion to workable materials. (✓)(✓)(✓) <u>Fibres and fabrics</u> Sources such as plants (cotton), animals, silk worms, oil, etc. (✓) and a description of the conversion to workable materials. (✓)(✓)(✓) <u>Design Engineering</u> Origins could link to any of the above materials (✓), but could also include the process of using a material to make a component. (✓)(✓)(✓)	**4** **AO4** **1 x 1a** **AO4** **3 x 1b**	**Do not credit** the specific material given. This has already been credited in 5 (a). 1 mark for identifying appropriate source. Up to 3 marks for describing the specific stages and processes undertaken to convert and prepare the material in a workable form. Candidates are not required to but may use sketches to support their answer. No marks should be awarded for the sketches themselves, but marks can be awarded appropriately for supporting annotation.

Question			Answer	Marks	Guidance	
					Content	Levels of response
6	(b)*		Social and ethical issues could relate to the use of a product, its materials or manufacture. Answers could cover: • sustainability considerations, such as: ○ cover sourcing and processing of virgin material. • social/ethical issues associated with sourcing material or processing, such as: ○ workers' rights and pay, fair trade Eti, ○ high temperatures, air and other pollution caused by processing etc… • moral and social issues could be environmental or economic factors, such as: ○ carbon footprint and transportation of materials and the product itself ○ disposal issues of waste products from processes. <u>Paper and boards; Natural and manmade timbers</u> Issues relating to use of timber and paper/card based products such as deforestation, sustainable forests. <u>Ferrous and non-ferrous metals</u> Use of metal-based materials, mining etc.	**8** **AO3** **4 x 2b** **AO4** **4 x 1c**	Candidates should be making the connections between social and ethical issues against the environmental issues when sourcing and processing materials. Candidates who do **not** address both social and ethical issues cannot access Level 3. *A candidate operating at Level 3 should be accessing all AO4 marks and at least two of the AO3 marks, covering both social and ethical issues and connecting these to environmental impact.* *A candidate operating at Level 2 could be accessing marks in a variety of ways. All AO4 marks with limited evaluation (AO3), or a clear evaluation covering social and/or ethical issues which may be connected to environmental impact.* *A candidate operating at Level 1 will be accessing AO4 marks, but no AO3 marks.*	**Level 3 (6–8 marks)** The candidate will show good knowledge and understanding of social and ethical issues that are applied when sourcing or processing material for use. There should be good consideration of the environmental connection to these issues in relation to the life cycle of a product or environmental impact. They will be able to undertake a thorough evaluation of the issues identifying positive and negative implications. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated with the use of examples. **Level 2 (3–5 marks)** The candidate will show good knowledge and understanding of social and/or ethical issues that are applied when sourcing or processing material for use. There will be some consideration of the environmental connection to these issues in relation to the life cycle of a product or environmental impact.

Question			Answer	Marks	Guidance	
					Content	Levels of response
			<u>Thermo and thermosetting polymers</u> Oil extraction, pollution, oil spills and depletion of supplies. <u>Fibres and fabrics</u> Harvesting and processing of cotton; use of chemicals; workers in mines, cotton fields etc. <u>Design engineering</u> Components are hard to recycle or re-use due to the mix of materials.			There will be limited reference to evaluating the issues. Evaluations will be one sided or limited to one factor. There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Maximum of 4 marks if no evaluation evident**. **Level 1 (1–2 marks)** The candidate will show limited knowledge and understanding of social or ethical issues that are applied when sourcing or processing material for use. There is no attempt at evaluation. The information has some relevance and is presented with limited structure or detail The information is supported by limited evidence. **Level 0 (0 marks)** No response or no response worthy of credit.

Assessment Objectives (AO) grid

Question	AO3	AO4
1a		3
1b		2
1c		2
1d (i)		1
1d (ii)		2
1e		2
1f (i)		2
1f (ii)*	4	4
2a (i)	1	2
2a (ii)	1	1
2b (i)		3
2b (ii)		3
2c		1
2d		2
2e		4
3a		4
3b (i)		1
3b (ii)	2	2
3c	2	4
4a		2
4b		1
4c (i)		1
4c (ii)		2
4d (i)		1
4d (ii)		1
4e		2
5a	2	7
5b (i)		2
5b (ii)		3
5c (i)		1
5c (ii)		2

Question	AO3	AO4
5d	4	2
6a		4
6b*	4	4
Total	20	80
Overall Total	100	

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