



National
Qualifications
2018

2018 Design and Manufacture
Higher
Finalised Marking Instructions

Scottish Qualifications Authority 2018

The information in this publication may be reproduced to support SQA qualifications only on a non-commercial basis. If it is reproduced, SQA should be clearly acknowledged as the source. If it is to be used for any other purpose, written permission must be obtained from permissions@sqa.org.uk.

Where the publication includes materials from sources other than SQA (secondary copyright), this material should only be reproduced for the purposes of examination or assessment. If it needs to be reproduced for any other purpose it is the centre's responsibility to obtain the necessary copyright clearance. SQA's NQ Assessment team may be able to direct you to the secondary sources.

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments. This publication must not be reproduced for commercial or trade purposes.

General marking principles for Higher Design and Manufacture

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.
- (c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.
- (d) For each candidate response, the following provides an overview of the marking principles. Refer to the specific marking instructions for further guidance on how these principles should be applied.
 - (i) Questions that ask candidates to **describe**
Candidates must provide a statement or structure of characteristics and/or features. This should be more than an outline or a list. Candidates may refer to, for instance, a concept, experiment, situation, or facts in the context of and appropriate to the question. Candidates will normally be required to make the same number of factual/appropriate points as are awarded in the question.
 - (ii) Questions that ask candidates to **explain**
Candidates must generally relate cause and effect and/or make relationships between things clear. This will be related to the context of the question or a specific area within a question.
 - (iii) Questions that ask candidates to **discuss**

Candidates must communicate ideas and information on a subject. It may be possible to debate two sides of the statement.

Marking instructions for each question

Section 1

Question		Expected response	Max mark	Additional guidance
1.	(a)	<p>Candidate explanations should relate to the materials chosen for the high chairs and/or their component parts/features.</p> <p>It should include the properties or benefits of the materials related to this product.</p>	6	<p>Six valid points at one mark each.</p> <p><i>No marks awarded for repetition of properties, benefits or characteristics.</i></p> <p>Solid beech:</p> <ul style="list-style-type: none"> • Strength, to hold the weight of the child • resistance to warping/straight grain • aesthetic qualities • workability • easy to clean/wipe down • durability. <p>Any other suitable explanation.</p> <p>Nylon:</p> <ul style="list-style-type: none"> • durable, resistant to wear • waterproof • flexible • strong • chemical resistance for cleaning • excellent abrasion resistance • recyclability. <p>Any other suitable explanation.</p> <p>NB only accept self-lubricating if explained.</p>

Question	Expected response	Max mark	Additional guidance
			<p>Polypropylene:</p> <ul style="list-style-type: none"> • chemical resistance for cleaning • good impact resistance • range of colours available • suitable for production methods • durability. <p>Any other suitable explanation.</p> <p>Tubular mild steel:</p> <ul style="list-style-type: none"> • durable • corrosion resistant due to finish • suitable for production methods • ease of cleaning due to finish • strength to weight ratio • lightweight for portability • tough. <p>Any other suitable explanation.</p> <p>ABS:</p> <ul style="list-style-type: none"> • range of colours available • good impact resistance • scratch resistant • chemical resistance/easy to clean • suitable for production methods • stain resistant. <p>Any other suitable explanation.</p>

Question	Expected response	Max mark	Additional guidance
			<p>PVC:</p> <ul style="list-style-type: none"> • range of colours available • chemical resistance/easy to clean • suitable for production methods • padded for comfort. <p>Any other suitable explanation.</p>

Question	Expected response	Max mark	Additional guidance
(b)	Candidates will name and explain why these are appropriate to the production of the high chairs. It is likely that they will relate to the materials used.	6	<p>Any three appropriate mass manufacturing processes and their relationships regarding suitability explained.</p> <p>Maximum of three marks for naming of processes. (1 mark each process)</p> <p>Maximum of three marks for explanations of suitability.</p> <p>One mark for each explanation of suitability; where more than one explanation is given to a process, a maximum of two marks per process should be awarded.</p> <p>NB Marks can be awarded for correct explanation for the feature produced, if an incorrect process is given.</p> <p>The tray has been rotationally moulded (0 marks) which allows for intricate detail. (1 mark)</p> <p>Restaurant style high chair:</p> <ul style="list-style-type: none"> • use of templates/jigs: to ensure consistency in size and accuracy of component parts. To reduce time of repetitive tasks • CNC routing/spindle moulding: to cut shaped sections (must make reference to CNC) clean finish, multiple sections of same shape cut together, accuracy • drilling: creates accurate holes for fittings - linked with JIGS • knockdown fittings: reference to standard components; benefits to manufacturer/consumer

Question	Expected response	Max mark	Additional guidance
			<ul style="list-style-type: none"> • injection moulding for polypropylene buckle to provide accuracy • piercing/blanking for fixtures/fittings • webbing/sewing/weaving for nylon belt • die casting of fixtures/fixings • staining for finishing. <p>Chicco High Chair:</p> <ul style="list-style-type: none"> • extrusion of tubular mild steel to provide continuous cross section • piercing and blanking of component parts to provide slots for adjusting, and holes for fixing • webbing/weaving/sewing for nylon strap • injection moulding of tray/ABS fixtures and fittings to provide accuracy • bending of tubular mild steel. <p>Statements could include:</p> <ul style="list-style-type: none"> • repeatability of process • accuracy of process • economies of scale (mass/batch) • shape/form is suitable for process • surface finish/no further finishing required • uniform cross section for extrusion • intricate detail • thin sheet (suitable for piercing and blanking). <p>Any other suitable answer.</p> <p>The frame of the Chicco chair has been extruded (1 mark) to achieve a consistent cross section. (1 mark)</p>

Question	Expected response	Max mark	Additional guidance
(c)	The candidate is expected to examine the aesthetics of the high chairs.	4	<p>Four appropriate comments at one mark each.</p> <p><i>Candidates must refer to four different aesthetic aspects. Responses should be based on aesthetic facts relating to the high chairs.</i></p> <p>Aesthetics are likely to be examined in terms of:</p> <ul style="list-style-type: none"> • shape • line • form • proportion • pattern • light • texture • colour • fashion • style/brand • contrast • harmony • balance/symmetry • market trends • suitability for target market. <p>The restaurant style high chair is natural in colour and traditional in style, which may make it appeal to a wider market. (2 marks)</p> <p>Contrast is created between the patterned seat and plain frame. (1 mark)</p>

Question	Expected response	Max mark	Additional guidance
(d)	The candidate is expected to describe any functional/safety issues.	5	<p>Five valid points at one mark each.</p> <p>Descriptions are likely to be drawn from:</p> <ul style="list-style-type: none"> • safely and securely hold a child • withstand continual/repeated use (durability) • easily portable/mobile/easily transported • easily cleaned/hygienic • safely and easily strap/belt the child into the seat/ease of adjustment • be stable when in use (safety of the child) • folded away/easily stored (Chicco only) • stackable/easily stored (wooden only) • easily assembled (Chicco only) • adjustable seating position (Chicco only) • comfort of child (Chicco only) • easy to use • safe to use (eg accessibility, opening/closing, carrying, cleaning, finger traps) • ease and safety of maintenance issues. <p>Any other appropriate descriptions.</p> <p>No sharp edges so baby won't hurt themselves. (0 marks)</p>

Question	Expected response	Max mark	Additional guidance
(e)	Candidates are expected to describe how production and planning systems can be used to improve efficiency.	4	<p>Four valid points at one mark each.</p> <p>Maximum of three marks per planning and production system.</p> <p>Examples are likely to include production and planning systems (with a related description on improving production efficiency) which could include:</p> <ul style="list-style-type: none"> • use of correct production type (one off/batch/mass/flow) • quality assurance (as part of a production/planning system) • Gantt charts • flowcharts • use of CNC, CAD/CAM • jigs/patterns/templates • JIT • standard components • sub-contracting • rapid prototyping. <p>Any other appropriate production and planning system explanation.</p> <p>Jigs can be used to ensure holes are drilled in the correct place. (1 mark)</p> <p>Gantt charts could be used to plan the manufacture of various stages to ensure all parts are ready to be assembled at the same time (1 mark), it also highlights when specialists are required. (1 mark)</p> <p>Batch production could be used to improve efficiency of manufacture as quality checks can be made more often. (1 mark)</p>

Section 2

Question		Expected response	Max mark	Additional guidance
2.	(a)	The candidate is expected to name a suitable thermosetting plastic and explain why this material is an appropriate choice.	3	<p>Maximum one mark for identification of material.</p> <p>Material selection:</p> <ul style="list-style-type: none"> • melamine formaldehyde • Bakelite • urea formaldehyde • phenol formaldehyde. <p>Any explanation from:</p> <ul style="list-style-type: none"> • electrical insulation • heat resistance/higher melting point than thermoplastics • scratch resistance • stiffness of material • durability/strength issues. <p>Any other suitable answer.</p> <p>NB Do not accept chemical resistant/easy to clean.</p> <p>NB Marks can be awarded for correct properties of the casing, if an incorrect material is given.</p> <p>Polypropylene (0 marks) this would be suitable as it is heat resistant. (1 mark)</p>

Question	Expected response	Max mark	Additional guidance
(b)	The candidate is expected to name a suitable manufacturing process and explain why this would be a good choice for the casing of these products.	3	<p>Maximum one mark for identification of manufacturing process.</p> <p>Process selection:</p> <ul style="list-style-type: none"> • compression moulding • thermoset injection moulding (do not accept injection moulding). <p>Any justification from:</p> <ul style="list-style-type: none"> • economies of scale • components are a suitable form for the process • process is suitable for thermosetting plastics • little or no wasted material • very accurate with little shrinkage • one piece production • quality surface finish • repeatability • intricate detail (injection moulding only). <p>Any other acceptable answer.</p> <p>NB Marks can be awarded for correct explanation for the feature produced, if an incorrect process is given.</p> <p>Injection moulding (0 marks) could be used as it would produce intricate detail. (1 mark)</p> <p>Die casting (0 marks) could be used as it would produce intricate detail (0 marks) and give a high quality finish. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
3.	(a)	The candidate is expected to describe two idea generation techniques.	4	<p>Four valid points at one mark each. Maximum of three marks per technique described/illustrated (no marks for naming technique). One mark for simple description/illustration. Two marks for full description/illustration. Three marks for an extended description/illustration.</p> <p>Responses should describe how the technique is used:</p> <ul style="list-style-type: none"> • brainstorming/thought showers • morphological analysis • technology transfer • analogy • lateral thinking • pencil for a walk/SAM • lifestyle/mood board • SCAMPER (may be done through sketch modelling) • biomimicry. <p>Any other suitable answer.</p> <p>Brainstorming is carried out as a group activity. The problem is stated in a simple manner and members of the group suggest solutions. (1 mark) All suggestions should be welcomed and there should be no criticism of any ideas. (1 mark) Group members are also encouraged to build on each other's ideas. (1 mark)</p> <p>In morphological analysis a table is made with columns of different options. (1 mark) One item from each column is selected at random to provide a description of a possible design. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
	(b)	The candidate is expected to describe anthropometric factors relating to the design of the kettle.	2	<p>One mark for each valid point.</p> <p>Candidates must relate anthropometrics to a part of the product. Ignore incorrect percentile range if given.</p> <p>Anthropometric influences in the design are likely to be:</p> <ul style="list-style-type: none"> • handle length • handle diameter (grip size) • handle 'gap' size • size and position of switches/controls • size of handle on lid • access for cleaning/maintenance. <p>Any other suitable answer.</p> <p>The length of the handle has to be the correct size to be lifted by everyone. (0 marks)</p> <p>The length of the handle has to be the correct size for the width of the hand so it can be lifted by everyone. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
	(c)	The candidate is expected to describe physiological factors relating to the design of the kettle.	2	<p>One mark for each valid point.</p> <p>Physiological influences in the design are likely to be:</p> <ul style="list-style-type: none"> • weight of kettle when empty and full (ease of lifting) • force required to operate buttons/switches • grip comfort • how easily it can be removed from the base • ease of opening and closing the lid • easy of pouring • ease of rotation on the base. <p>Any other suitable answer.</p>

Question		Expected response	Max mark	Additional guidance
4.	(a)	The candidate is expected to explain why stainless steel would be a good choice for these utensils.	3	<p>One mark for each valid point.</p> <p>Responses are likely to include:</p> <ul style="list-style-type: none"> • corrosion resistance • aesthetic qualities • hygiene, easy to clean • durability of material • malleable • suitable for production methods • ability to withstand high temperatures when cooking. <p>Any other suitable answer.</p> <p>NB no marks should be awarded for strength to weight ratio.</p>
	(b)	The candidate is expected to explain the suitability of press forming for the manufacture of the kitchen utensils.	2	<p>One mark for each valid point.</p> <p>Responses are likely to draw from the following characteristics of the processes:</p> <ul style="list-style-type: none"> • material in thin sections • form of product is suitable for these processes • accuracy of sizes • repeatability/consistency in quality • no further finishing • increased strength of component after pressing • economies of scale (price per unit). <p>NB do not accept mass production if not explained.</p> <p>Any other suitable answer.</p>

Question		Expected response	Max mark	Additional guidance
	(c)	The candidate is expected to describe the impact of fully automated manufacturing technology on people and society.	2	<p>One mark for each valid point.</p> <p>Response are likely to include:</p> <ul style="list-style-type: none"> • reduced work force • demand for skilled workforce • workers will have to learn new skills • de-skilling of work force • changed work patterns • mass consumerism/products produced at lower cost, society can easily afford • population migration • environmental impact (do not accept pollution). <p>Any other suitable answer.</p>

Question	Expected response	Max mark	Additional guidance
(d)	The candidate is expected to describe how consideration for environmental issues has impacted on the design and manufacture of products.	3	<p>One mark for each valid point.</p> <p>Responses are likely to focus on the following:</p> <ul style="list-style-type: none"> • using recyclable materials • materials from sustainable sources • labelling of plastic components to assist recycling • use of recycled materials in the manufacture of the product • use of processes that do not cause harm to the environment • manufacture of the product close to the market to minimize transport • efficient machinery • easily dismantled products • easily transported (lightweight/stackable) • reduced volume of material used in each product • reduce number of materials used • reduce number of processes used • minimise waste (during production) • reuse components • reduced or no packaging • efficient in use ('A' rated products) • use of 'green' materials as an alternative • use of renewable energy for production • use of durable materials to increase lifespan of product. <p>Any other suitable answer.</p> <p>Designing cars to be run using electricity has had an impact on the environment by reducing the volume of pollutants into the atmosphere (1 mark), this can also be achieved in fuel driven cars by designing them to be more aerodynamic. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
5.	(a)	The candidate is expected to describe technology push and market pull and give an example of how each has influenced the design of products.	4	<p>One mark for a valid description of technology push.</p> <p>One mark for a valid description of market pull.</p> <p>One mark for a valid example of the influence of each (No marks for repetition).</p> <p>Technology push is when research and development in new technology drives the development of new products. It tends to start with a company developing an innovative technology and applying it to a new product.</p> <p>It is likely that candidates will draw from common technology push aspects such as:</p> <ul style="list-style-type: none"> • touch screen technology • 3D graphics ability • miniaturisation • wi-fi capability • improving audio technology • improvements in graphics/video technology • compatibility with existing products/previous version(s) of product • health and fitness benefits • increased memory capability • ‘cloud’ storage • new/improved materials. <p>Any other suitable answer.</p>

Question	Expected response	Max mark	Additional guidance
			<p>The term market pull refers to the need/requirement for a new product or a solution to a problem, which comes from the market place. The need is identified by potential customers or through market research. A product or a range of products are developed, to solve the original need.</p> <p>It is likely that candidates will draw from common market pull aspects such as:</p> <ul style="list-style-type: none"> • need for accessibility • affordability • portability • improved quality (of product) • online features • compatibility with existing products/previous version(s) of products • health and fitness benefits • different pull from different age groups • aesthetics - colour/style options • add-ons - different accessories. <p>Any other suitable answer.</p>

Question		Expected response	Max mark	Additional guidance
	(b)	The candidate is expected to describe the information that could be gained through the use of market research.	2	<p>Two valid points at one mark each.</p> <p>Responses are likely to include:</p> <ul style="list-style-type: none"> • identify the market wants and needs • check existing products currently on the market • potential competitors • ensure a suitable market exists • product comparison • price comparison • legislation restrictions • consumer knowledge of up-to-date materials and technology • identify appropriate materials for manufacture. <p>Any other suitable answer.</p>
	(c)	The candidate is expected to describe the benefits of using rapid prototyping to develop new products.	2	<p>Two valid points at one mark each.</p> <p>Do not accept answers which are generic to modelling.</p> <p>Responses are likely to include:</p> <ul style="list-style-type: none"> • reduced lead times (quicker to market) • reduced costs incurred in R&D mean products which were marginal become profitable • accuracy of model • model/components made in actual material for testing • ability to edit and make changes to the design relatively quickly • reduced outsourcing to specialist model makers. <p>Any other suitable answer.</p>

Question	Expected response	Max mark	Additional guidance
(d)	The candidate is expected to describe a method that could be used to test the performance of product and describe the information that could be gained.	3	<p>One mark for describing method (no marks for simply naming):</p> <ul style="list-style-type: none"> • user trial • user trip • test rig • simulation testing <p>Two valid points at one mark each.</p> <p>Responses are likely to include:</p> <ul style="list-style-type: none"> • ease of use • ease of maintenance/ease of cleaning • durability of construction • ergonomic issues (comfortable to hold etc.) • functional issues (fit for purpose) • battery life/recharge time • materials testing (component parts, durability, continual use etc.) • environmental testing (energy performance etc.) • compatibility with accessories • feedback to design team (flaws/potential improvements). <p>Any other suitable answer.</p>

Question		Expected response	Max mark	Additional guidance
	(e)	The candidate is expected to describe planned obsolescence and give an example of how it has influenced the design of a product.	2	<p>One mark for description of planned obsolescence.</p> <p><i>Planned obsolescence is a strategy used in the design of products to give the product a specific lifespan to cause the product to be perceived as obsolete before it actually needs to be replaced.</i></p> <p>One mark for example of how it has influenced a product.</p> <p>Responses may include:</p> <ul style="list-style-type: none"> • changes in fashion/style • ability to change parts of the product eg covers, personalisation • durability of parts, materials and construction • maintenance/replacement issues • compatibility of software/hardware • technology slowing down/lagging. <p>Any other relevant answer.</p>

Question	Expected response	Max mark	Additional guidance
6.	<p>This question is set to test the candidate’s ability to present a reasoned response regarding the role of the design team members and the interactions between them.</p> <p>Although there is an underlying body of knowledge required to answer it, there is a very wide range of possible answers. Therefore, the question is marked holistically.</p> <p>The candidate response should demonstrate: knowledge of the subject matter and an ability to comprehend the question using clear examples to support the points made.</p>	8	<p>Marks should be awarded using the range statements in the table below.</p> <p>Candidate responses are likely to make reference to some of the aspects below:</p> <ul style="list-style-type: none"> • Accountant - Budgets the project. Offers advice to the designer on the costing of the project, restrictions, etc. An Accountant would be responsible for overseeing all the costs related to the design and manufacture of the product. They would be responsible for managing the profit and losses and would liaise directly with the client and other specialists during the process. • Materials technologist - Has knowledge of materials and their properties. Offers advice to the designer about the materials which would be best suited to the job, taking into consideration their properties, working characteristics, cost, availability, etc. The materials technologist provides advice on the selection of suitable materials for manufacture of the product depending on the target market. They work closely with production specialists to ensure that any materials selected are suited to the methods of production available.

Question		Expected response	Max mark	Additional guidance
6.				<ul style="list-style-type: none"> • Production specialist - Has strong knowledge of available processes and offers this to the designer during certain stages of the design process. Will try to find the most suitable method of production for a product by taking into consideration economics, environmental concerns, materials, availability, etc. Production specialists provide advice on production planning and tooling for manufacture. They liaise with engineers and material technologists to ensure that the product is produced as efficiently as possible. • Marketing team - Carries out research on what consumers' wants/needs are. Compiles findings and presents to the designer. Is involved in the advertising and promotion. Aids with sales of the product. <p>NB candidates must refer to the influence specialists have on each other's decisions to achieve marks in the top two bands.</p>

0-2 Marks	3-4 Marks	5-6 Marks	7-8 Marks
<p>An answer which falls into this category may do so for a number of reasons.</p> <ul style="list-style-type: none"> • Limited knowledge of the subject matter and understanding of the role of the design team members will be demonstrated. • Very few points are made. • No understanding of connections between members of the design team. • Much of the response does not answer the question. 	<p>An answer which falls into this category may do so for a number of reasons.</p> <ul style="list-style-type: none"> • Adequate knowledge of the subject matter and understanding of the role of the design team members will be demonstrated. • The answer will be relevant to the question. • No understanding of connections between members of the design team. • Although examples are used, points made are unclear. 	<p>An answer which falls into this category may do so for a number of reasons.</p> <ul style="list-style-type: none"> • Secure knowledge of the subject matter and understanding of the role of the design team members will be demonstrated. • The answer will be relevant to the question demonstrating a good level of comprehension. • Some understanding of connections between members of the design team. • Most points made are clear and examples are used to support them. 	<p>An answer which falls into this category may do so for a number of reasons.</p> <ul style="list-style-type: none"> • Extensive knowledge of the subject matter and understanding of the role of the design team members will be demonstrated. • The answer will be relevant to the question demonstrating a high level of comprehension. • Clear understanding of connections between members of the design team. • All points made are clear and examples are used to support them.

[END OF MARKING INSTRUCTIONS]