



National
Qualifications
2015

2015 Design and Manufacture

New Higher

Finalised Marking Instructions

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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.

Detailed Marking Instructions for each question

Section 1

Question		Expected response	Max mark	Additional guidance
1.	(a)	Candidate explanations should relate the materials chosen to identified aspects, features, parts and/or components of the product(s) and will include properties/benefits/characteristics of the materials.	6	<p>Valid explanations of six choices at 1 mark each.</p> <p>Candidates may focus more of their responses on one product than the other, but should still cover both products in their response. (max 5 per product)</p> <p>Properties/benefits/characteristics are likely to be drawn from:</p> <ul style="list-style-type: none"> • Durability of material (corrosion resistant/non-corroding, scratch resistant, impact resistant, not moisture absorbent) • Availability of materials (eg standard forms of supply) • Strength to weight considerations • Flexibility (collapsible wheelbarrow) • Rigidity • Suitability for production methods • Function of component parts • Aesthetic appeal • Ease of cleaning • Recycling • Cost • Malleability • Ductility <p>Any other valid material property explained in relation to an identified feature/function.</p> <p>Eg The powder-coated mild steel tube has been used for the frame of the Wheeasy collapsible wheelbarrow as this material is corrosion resistant, hard wearing and relatively lightweight in this form. (3 marks)</p> <p>NB No repetition of properties/benefits or characteristics.</p>

Question		Expected response	Max mark	Additional guidance
	(b)	The candidate will have named and explained three types of mass manufacturing processes used in the production of the illustrated products, and how production processes relate to the material used.	6	<p>Any three appropriate mass manufacturing processes and their relationships regarding suitability explained.</p> <p>Maximum of 3 marks for naming of processes (1 mark each process).</p> <p>Maximum of 3 marks for explanations of suitability. Where more than one explanation is given to a process, a maximum of two marks per explanation of process can be awarded.</p> <p>Processes are likely to be drawn from:</p> <ul style="list-style-type: none"> • Wheeleasy wheelbarrow - extrusion, cold rolling, bending, injection moulding, piercing/blanking, powder coating, plastic dip coating, stitching (waterproof cloth), metal turning • Endurance wheelbarrow - press formed (tray & struts), drilling, extrusion, cold rolling, injection moulding, galvanising, metal turning <p>Suitability of the mass manufacturing processes should relate to the ways in which the processes/manufacturing/ assembly techniques named are influenced by volume of production. This can include explanations of suitability which refer to:</p> <ul style="list-style-type: none"> • Standardisation of components/sizes, component parts all the same size. No further finishing required. Process related to form of component. • Repeatability and accuracy. Economies of scale - mass continuous production <p>or any other aspect.</p> <p>Eg The handles and frame for the Endurance wheelbarrow will be manufactured using extrusion (1 mark) as this gives a consistent cross-section. (1 mark)</p> <p><i>NB marks can be awarded for correct explanation of an incorrect process</i></p>

Question		Expected response	Max mark	Additional guidance
	(c)	The candidate is expected to describe any four aspects in relation to terms of physiological and psychological factors.	4	<p>Four descriptions at 1 mark. (maximum of 3 marks for either aspect)</p> <p>Physiological influences in the design are likely to be:</p> <ul style="list-style-type: none"> • Weight of product • Length of handle • Distance from handle to wheel • Grip comfort <p>Marks may also be awarded for relating physiology to the product: Strength issues, posture, reach, manoeuvrability</p> <p>Psychological influences in the design are likely to be:</p> <ul style="list-style-type: none"> • Looks easy to use • Feels robust/stable • No squeaks or rattles in use • Audibly clicks reassuringly into place (Wheeleasey) • Looks easy to assemble (Wheeleasey) • Looks fit for purpose • Comfortable handles • Looks like a quality product <p>Eg</p> <p>The Wheeleasey wheelbarrow is much lighter so requires less strength (1 mark) and it's easier for the user to load (1 mark) although it may appear limited in terms of the weight it could carry (1 mark).</p> <p>The Endurance wheelbarrow has a solid frame that will suit the posture of the user (1 mark), the polypropylene handles will provide a comfortable grip (1 mark) and its simple design allows it to be used easily (1 mark).</p>

Question		Expected response	Max mark	Additional guidance
	(d)	The candidate is expected to describe any five functional needs and have covered aspects of both products.	5	<p>Five needs at 1 mark each. (maximum 4 marks for any one wheelbarrow)</p> <p>Any five functional descriptions are likely to be drawn from:</p> <ul style="list-style-type: none"> • The need to move building materials/soil/garden waste • The need to securely hold materials/soil/garden waste • The need to withstand continual/repeated (heavy) use • The need to be easily portable/mobile • The need to be easily cleaned • The need to be able to carry large/heavy objects (Endurance only) • The need to withstand outdoor conditions • The need to be stable • The need to be collapsible (Wheeleasey only) • The need to be easily stored • The need to be easily assembled (Wheeleasey only) <p>or any other appropriate functional descriptions.</p>
	(e)	Candidates are expected to explain how the use of standard components benefits the manufacturer.	4	<p>Four explanations at 1 mark each.</p> <p>Responses are likely to include:</p> <ul style="list-style-type: none"> • Reduced costs (explained) • Ensures consistency/less waste/improved Quality Assurance • Ease of ordering (readily available) • Sourcing reduces lead time • Speeds up production process • Allows JIT • Reduces the number of manufacturing processes • Standard sizes simplifies production process • Greater flexibility in manufacture (can be used on other products) • Simplifies staff training • Simplifies assembly • Simplifies the use of a mass production line <p>or any other appropriate answer relating to advantages of using standard</p>

Question	Expected response	Max mark	Additional guidance
			components

Section 2

Question		Expected response	Max mark	Additional guidance
2.	(a)	<p>The candidate is expected to explain the benefits of using laminated wood for this type of application.</p> <p>Responses likely to include:</p> <ul style="list-style-type: none"> • Strong 3D forms • Stable material • Enhance aesthetics of chair (explained) • No need for wood joints • Lightweight shell structure • Material available in standard sheet sizes • Cost effective • Manufacturing methods • Material from renewable source <p>Any other suitable explanation.</p>	3	<p>Three benefits are explained for 1 mark each.</p> <p>Eg</p> <p>Strong 3D forms can be produced. (1 mark)</p> <p>Making a 3D form with one piece of wood will reduce the number of joints in the piece of furniture. (1 mark)</p> <p>Laminated wood is less likely to warp or twist. (1 mark)</p> <p>A variety of different outer veneers can be used to alter the appearance of the design. (1 mark)</p> <p>Standard sheet sizes allow maximum use of material. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
	(b)	<p>The candidate is expected to explain why die casting was used for the base of the chair.</p> <p>Responses are likely to draw from two of the following characteristics of die casting:</p> <ul style="list-style-type: none"> • Accuracy • Complexity • High quality finish • Fine detail possible • Economies of scale • Repeatability • Automated process • Suited to low melting point metals <p>Any other suitable explanation</p>	2	<p>Two appropriate explanations at 1 mark each.</p> <p>Eg</p> <p>Die casting was used to manufacture the base of the chair because a high quality finish can be achieved and this would be an important factor in the manufacture of a piece of lounge furniture. (1 mark)</p> <p>Die casting allows for a high degree of accuracy and this would be important so that other components such as the feet or central column can easily fit into the base. (1 mark)</p> <p>Die casting can be automated allowing the production of this component in large numbers at a relatively low cost. (1 mark)</p> <p><i>NB - No marks awarded for mass production</i></p>

Question		Expected response	Max mark	Additional guidance
	(c)	<p>The candidate is expected to explain ways in which the production of this can be made more efficient.</p> <p>No marks for naming production and planning systems.</p> <p>Responses are likely to include the following methods.</p> <ul style="list-style-type: none"> • Use of planning systems such as Gantt charts • Use of systems such as batch or flow production • Use of jigs and fixtures to speed up assembly • Use of CNC machinery for some processes • Buying in standard components • Sub-contracting some processes • Just in time production <p>Any other suitable explanation</p>	3	<p>Three appropriate explanations at 1 mark each.</p> <p>Eg</p> <p>Gantt charts could be used to plan the manufacture of the various parts of the chair such as the plywood, the cushions and the base. Each process could be carried out at an appropriate stage to ensure that all parts are ready to be assembled at the same time. (1 mark)</p> <p>Jigs could be used to ensure that holes are drilled in the correct places. This would remove the need for marking out thus speeding up production. (1 mark)</p> <p>Sub-contracting specialist processes such as the upholstery would enable the manufacturer to focus on the processes that they do well. It would also remove the need to investments in specialist machinery. (2 marks)</p>

Question		Expected response	Max mark	Additional guidance
3.	(a)	<p>The candidate is expected to explain three benefits of rotational moulding as it relates to the production of the play seat.</p> <p>Responses are likely to draw from three of the following characteristics of rotational moulding:</p> <ul style="list-style-type: none"> • Closed hollow form • Relatively low tooling costs • No weak areas due to consistent wall thickness • Good quality exterior finish/texture • Large products can be made relatively cheaply • One piece construction • The mould can be designed to allow thicker areas where strength is required • Suitable for batch production • Repeatability • Measured amount of material, less wastage <p>Any other suitable response</p>	3	<p>Three explanations at 1 mark each.</p> <p>Eg</p> <p>The process will allow the production of a hollow form (1 mark). This will make it relatively strong and also lightweight (1 mark).</p> <p>Rotational moulding will create a product with a constant wall thickness and therefore there will not be any weak parts to the product. (1 mark)</p> <p>Tooling costs for rotational moulding are relatively low (1 mark) and allow the production of large products. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
	(b)	<p>The candidate is expected to name a suitable plastic for the seat.</p> <p>Acceptable materials are:</p> <p>HDPE Polypropylene ABS</p> <p>Reasons for choice should focus on toughness and durability relating to typical uses of a toy and/or aesthetic properties, easily formed (suitable for process).</p> <p>Any other suitable response</p>	3	<p>1 mark for identifying a suitable plastic and 1 mark for each valid explanation up to two marks.</p> <p>HDPE would be a suitable plastic (1 mark) as it is a tough material that would withstand rough treatment from children (1 mark). HDPE is available in a range of bright colours (1 mark).</p> <p>Reasons should relate to the play seat.</p> <p><i>Up to 2 marks can be awarded for valid explanations of incorrect or no material</i></p>

Question		Expected response	Max mark	Additional guidance
	(c)	<p>The candidate is expected to describe two safety issues that would influence this product.</p> <p>Responses are likely to focus on the following:</p> <ul style="list-style-type: none"> • Stability • No small parts • Non -toxic materials • Safe edges • Seat height <p>Any other suitable response</p> <p>Answers repeated from part (b) will not attract marks.</p>	2	<p>Two descriptions at 1 mark each.</p> <p>Eg</p> <p>The seat would need to be stable when a child is sitting or playing on it. (1 mark)</p> <p>The seat should be made from non-toxic materials as young children often try to put objects in their mouths. (1 mark)</p> <p>The seat should have no finger traps. Shatterproof materials. Easy to clean/no dirt traps.</p> <p>No marks can be awarded for stating - No sharp edges (without description)</p>

Question		Expected response	Max mark	Additional guidance
	(d)	<p>The candidate is expected to describe how the impact of their products on the environment could be reduced.</p> <p>Responses are likely to focus on the following:</p> <ul style="list-style-type: none"> • Easily recycled materials • Sustainable sources • Labeling of plastic components to allow 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 • Dismantling products • Transport • Reduced volume of material • Reuse components <p>Any other suitable response</p>	4	<p>Four descriptions at 1 mark each.</p> <p>Eg</p> <p>Clear labelling of the plastic material would allow it to be easily sorted during the recycling process. (1 mark)</p> <p>A proportion of the materials used in the manufacture of the product could come from recycled or sustainable sources. (1 mark)</p> <p>Manufacture close to the market to reduce impact of transportation. (1 mark)</p> <p>Manufacturer make investment in efficient plant/machinery. (1 mark)</p> <p>Reduced volume/number of material(s) used without compromising performance. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
4.	(a)	<p>The candidate is expected to describe how this radio has been influenced by needs of the target market.</p> <p>Responses are likely to include:</p> <ul style="list-style-type: none"> • Durable materials • Robust construction • Safety features - somewhere to wind the cable • Ease of operation • Easily seen • Large speakers - increased volume • Portability (easily carried) • Secondary function (battery charger) • No requirement for mains power <p>Any other suitable response</p>	3	<p>Three descriptions that focus on the design features of the radio that make it suitable for a building site. Three descriptions at 1 mark each.</p> <p>Eg</p> <p>The rugged construction will help it to withstand knocks and bumps. (1 mark)</p> <p>The frames at the ends will help to protect the radio. (1 mark)</p> <p>The feature enabling the cable to be wound up will make it easy to transport and will reduce the trip hazard. (2 marks)</p> <p>The large handle makes it easy to carry and protects the top of the radio. (2 marks)</p>

Question		Expected response	Max mark	Additional guidance
	(b)	<p>The candidate is expected to explain how anthropometrics has been considered.</p> <p>There should be a clear link between a part of the product and a human dimension. (ignore incorrect percentile ranges)</p> <p>Responses likely to include:</p> <ul style="list-style-type: none"> • Handle length • Handle diameter • Gap between handle and radio • Size and position of controls <p>Any other suitable answer</p>	2	<p>Two explanations at 1 mark each.</p> <p>Eg</p> <p>The length of the handle would be influenced by the broadest hand width (1 mark).</p> <p>The size of the buttons should be suited to the largest finger width (1 mark) and be positioned to allow them to be operated easily (1 mark)</p> <p>Incorrect use of percentile ranges should not influence marks awarded</p>
	(c)	<p>The candidate is expected to describe how the designer could evaluate fitness for purpose.</p> <p>Responses likely to include;</p> <ul style="list-style-type: none"> • Use of prototypes to check suitability of function/materials • Testing/test rigs • User trip/trials <p>Any other suitable answer</p>	2	<p>The radio charger could be used by a range of professionals to test how well it performs in various environments (1 mark) and the opinions can be gathered using a survey or interview (1 mark)</p> <p>1 mark for a simple description - 2 marks for extended answer</p>

Question		Expected response	Max mark	Additional guidance
	(d)	<p>The candidate is expected to explain the benefits of a brand image in a design such as this.</p> <p>Responses likely to include:</p> <ul style="list-style-type: none"> • Brand recognition • Brand loyalty • Self-promotion • Increased market share • Perceived reliability <p>Any other suitable answer</p>	2	<p>Two explanations at 1 mark each.</p> <p>Eg</p> <p>If all products have a similar style then it is easy for customers to recognise the brand in shops or advertising (1 mark).</p> <p>Creating a positive brand image can help to encourage brand loyalty with customers (1 mark).</p> <p>Branded products are perceived as reliable and good quality (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
5.	(a)	<p>The candidate is expected to describe two methods that would be used to gather market research information.</p> <p>Responses are likely to include any of the following methods:</p> <ul style="list-style-type: none"> • Focus groups • Questionnaires • Surveys • Analysis of existing products • Analysis of current market trends <p>Any other suitable methods</p>	2	<p>Two appropriate descriptions at 1 mark each. (no marks for naming methods)</p> <p>Eg</p> <p>A group of children could be gathered together as a focus group and asked to describe the types of games and activities that they enjoy. (1 mark)</p> <p>They may be asked to play various games that would give the designer an idea of the types of activities that the children enjoy. (1 mark)</p> <p>An analysis of the current market by looking on the internet or in shops would give the designer an idea of the types of games that are popular. (1 mark)</p>

Question		Expected response	Max mark	Additional guidance
	(b)	<p>The candidate is expected to explain an advantage and disadvantage of using external designers.</p> <p>Responses are likely to draw on any of the following advantages or disadvantages:</p> <p>Advantages</p> <ul style="list-style-type: none"> • External designers are only hired when needed • External designers may provide fresh ideas • External designers may have specialist skills and knowledge <p>Disadvantages</p> <ul style="list-style-type: none"> • External designers charge higher fees • External designers may not be familiar with the work practices in the company • IPR Issues <p>Any other suitable answer</p>	2	<p>Two appropriate explanations at 1 mark each. Answer should include one advantage and one disadvantage to attract full marks.</p> <p>Eg</p> <p>The toy company may only need the services of the external designers for a short time rather than a full time design team. Therefore they can be hired when needed. Thus saving money.</p> <p>External designers work on various projects and can often inject fresh ideas into a design project because they may look at the design problem from a new perspective.</p> <p>External designers can charge higher fees than in-house designers therefore the toy company should carefully manage the work that the consultants are commissioned to do.</p>

Question		Expected response	Max mark	Additional guidance
	(c)	<p>The candidate is expected to describe two idea generation techniques.</p> <p>Responses should describe how the technique generates ideas and are likely to draw from any two of the following:</p> <ul style="list-style-type: none"> • Brainstorming/thought showers • Morphological analysis • Technology transfer • Analogy • Lateral thinking • Taking pencil for a walk • Lifestyle/Mood Board • Mind Mapping <p>Any other suitable technique</p>	4	<p>1 mark for simple description/illustration 2 marks for full description/illustration 3 marks for an extended description/illustration</p> <p>A maximum of 3 marks per technique described/illustrated.</p> <p>No marks for simply naming the technique.</p> <p>Eg</p> <p>Brainstorming This idea generation technique 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>Morphological analysis The product is divided into categories of parameters. A list of options for each parameter is drawn up. (1 mark) One item from each category is selected at random to provide a description of a possible design. (1 mark)</p>

Question	Expected response	Max mark	Additional guidance
6.	<p>This question is set to test the candidate's ability to present a reasoned discussion about a design issue.</p> <p>Although there is an underlying body of design knowledge required to answer it, there is a very wide range of possible answers. Therefore the question is marked holistically.</p> <p>The features which are looked for are knowledge of the subject matter, and ability to comprehend the question and construct an answer which uses clear examples to support the points made.</p> <p>The table below is designed to assist with the placing of answers within the full mark range.</p>	8	<p>Explanations are likely to make reference to some of the aspects below:</p> <ul style="list-style-type: none"> • Shape of the product(s) • Form of the product (s) • The use of line • The use of proportion • The use of balance • The use of colour as an emotional/symbolic association /branding • Using colour to aid interaction with the product • Using colour to emphasise the physical form of the product(s) • The influences of fashion on design • The influences of style on design • Making products visually compatible with environment • The use of contrast • The use of harmony • The use of texture to enhance visual appeal • Following market trends • Product(s) that use aesthetics to appeal to a particular target group • The use of aesthetics to confirm/display status • Use of detail/pattern to highlight product(s) <p>or any other appropriate aspect.</p> <p>Whilst the response can include these aspects, it should be noted that the candidate may include others depending on the product(s) referenced.</p>

The candidate responses will show the following characteristics for:			
0-2 marks	3-4 marks	5-6 marks	7-8 marks
<ul style="list-style-type: none"> Minimal knowledge and understanding of the subject matter. Minimal range of aesthetic factors explained. Very few relevant points are made. Response does not answer the question. Response lacks detail. 	<ul style="list-style-type: none"> Limited knowledge and understanding of the subject matter. Limited range of aesthetic factors explained. Some relevant points are made. Although examples are used, points made are unclear. 	<ul style="list-style-type: none"> Secure knowledge and understanding of the subject matter. Adequate range of aesthetic factors explained. Several clear points are made and examples are used to support them. 	<ul style="list-style-type: none"> Extensive knowledge and understanding of the subject matter. Wide range of aesthetic factors explained in relation to products. The answer will be relevant to the question demonstrating a high level of comprehension. Detailed references to products

[END OF MARKING INSTRUCTIONS]