National
Qualifications
2016

Design and Manufacture

Advanced Higher

Finalised Marking Instructions

SQA
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General Marking Principles for Advanced 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 Detailed 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)		This question is set to test the candidates knowledge and understanding of the contribution to design made by a selected design movement. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Typical answers are likely to have made reference to: • a design movement's main contribution to design • a design movement's inspiration, design ideals and philosophies • a design movement's principles influence on the work of others • public reaction to a design movement's work at the time • impact of advances in science, technology and materials • reaction to social attitudes, trends and fashion	**10**	Marks should be awarded using the best fit characteristics shown below. Where candidates have not clearly identified a recognised design movement, marks may be allocated if a period of time has been identified.

Question			Expected response		Max mark	Additional guidance	
			0-2	3-4	5-6	7-8	9-10
			It demonstrates very limited knowledge and understanding of the subject matter. Limited consideration of few aspects from: • main contribution to design. • inspiration, design ideals and philosophies. • principles influence on the work of others. • public reaction at the time. • impact of advances in science, technology and materials. • reaction to social attitudes, trends and fashion.	It demonstrates limited knowledge and understanding of the subject matter. Adequate consideration of few aspects from: • main contribution to design. • inspiration, design ideals and philosophies. • principles influence on the work of others. • public reaction at the time. • impact of advances in science, technology and materials. • reaction to social attitudes, trends and fashion.	It demonstrates fair knowledge and understanding of the subject matter. Fair consideration of aspects from: • main contribution to design. • inspiration, design ideals and philosophies. • principles influence on the work of others. • public reaction at the time. • impact of advances in science, technology and materials. • reaction to social attitudes, trends and fashion.	It demonstrates good knowledge and understanding of the subject matter. Good consideration of aspects from: • main contribution to design. • inspiration, design ideals and philosophies. • principles influence on the work of others. • public reaction at the time. • impact of advances in science, technology and materials. • reaction to social attitudes, trends and fashion.	It demonstrates very good knowledge and understanding of the subject matter, Detailed consideration of aspects from: • main contribution to design. • inspiration, design ideals and philosophies. • principles influence on the work of others. • public reaction at the time. • impact of advances in science, technology and materials. • reaction to social attitudes, trends and fashion.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates will be expected to have described how advances in computer technology have impacted on the manufacturing industry. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Typical answers are likely to include: • Use of CAD – direct input into manufacture, efficient communication, reduce lead time • Computer simulation - improved testing, less risk of failure • Rapid prototyping – freedom to generate complex forms, tailored products, creation of jigs, improved testing • Rapid manufacture-small production runs of one-offs, flexible production, reduced or no assembly required • CNC machining - flexible production, accuracy, efficient mould manufacture, small production runs • Computer Integrated Manufacture - flow production, mass manufacture • Automation – standardisation, flow production, efficient, flexible • Stock control – efficient, JIT, • Quality control – total quality management • Improved communication-subcontracting manufacture or production	**6**	Candidates may refer to the use of computers throughout the *design* and manufacture of products provided it is tied in with the impact on manufacturing industry. Marks should be awarded using the best fit characteristics shown below.

Question			Expected response		Max mark	Additional guidance	
			0-2	3-4			5-6
			It demonstrates a limited knowledge and understanding of the subject matter. There is little reference to how advances in computer technology have impacted on the manufacturing industry. General reference to computerisation in the manufacture of products. Generic and vague references to changes in the manufacture of products. Few points are made. Does not address the question. Simply too thin.	It demonstrates knowledge of the subject matter and an understanding of the main aspects are demonstrated. There is general reference to how advances in computer technology have impacted on the manufacturing industry. Clear reference to the use of computers in the manufacture of products. Clear references to changes in the manufacture of products. References made to products or companies to exemplify answer.			It demonstrates knowledge of the subject matter and a secure understanding of the main aspects are demonstrated. Selected reference to how advances in computer technology have impacted on the manufacturing industry. Specific reference to the use of computers in the manufacture of products. Considered references to changes in the manufacture of products. References made to products or companies to exemplify answer.

Question			Expected response	Max mark	Additional guidance
	(c)		Typical answers are likely to include: • Increased competition • Risk of failure • Investment • Brand identity • Sales volume • Products are very similar • Lack of choice • Larger market • Larger customer base	**4**	1 mark for each valid point made, leading to a clear explanation as to why marketing has become an important activity in a global market.

Question			Expected response	Max mark	Additional guidance
	(d)		Candidates will be expected to have explained why ergonomics has been so influential to the evolution of products. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Typical answers are likely to include: • Mass manufacture of products • Products have to be more inclusive used by 95% of the population • Change from one off design to mass production • Need for greater sales • Marketing opportunity • Improved performance • More complex products • Standardisation of products • Global markets • Increased awareness • Competition • Marketing • Consumer expectation • Safety • Legislation • Health	**6**	Marks should be awarded using the best fit characteristics shown below.

Question			Expected response	Max mark	Additional guidance	
			0-2	3-4		5-6
			It demonstrates a limited knowledge and understanding of the subject matter. There is little reference to the reasons for ergonomics becoming so influential to the design and evolution of products. Few points are made. Little/no reference to products. Does not address the question. Simply too thin.	It demonstrates knowledge of the subject matter and an understanding of the main aspects are demonstrated. General reference to the reasons for ergonomics becoming so influential to the design and evolution of products. Vague reference to products.		It demonstrates knowledge of the subject matter and a secure understanding of the main aspects are demonstrated. Selected reference to the reasons for ergonomics becoming so influential to the design and evolution of products. Clear reference to products.

Question			Expected response	Max mark	Additional guidance
	(e)		Typical answers are likely to include: • Planned obsolescence • Reduction in quality • Increased sales • Holding back technology and features • Reduction in cost • More pressure to consider the environment • Value for money • Durability • Maintenance • Reparability • Spin off products	**4**	To gain full marks candidates will have considered how companies take advantage of fashion **and** how products manufacture is influenced by constant changes in fashion. 1 mark will be awarded for each valid point relating to how companies take advantage of changes in fashion. Maximum 3 marks. 1 mark will be awarded for each valid point relating to how a products manufacture is influenced by constant changes in fashion. Maximum 3 marks.

Section 2

Question			Expected response	Max mark	Additional guidance
2.	(a)		Candidates will be expected to have described suitable activities that could be used to ensure the Initial Easy Changer is comfortable, safe and easy to use. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Typical answers are likely to include: • Testing prototypes • Test rigs • User trips • User trials • Use of outside agencies • Focus groups		Marks should be awarded using the best fit characteristics shown below.

0-2 marks	3-4 marks	5-6 marks
Description demonstrates a limited knowledge and understanding of the subject matter. Limited understanding is shown of activities used to ensure comfort or safety or ease of use. Basic descriptions lacking detail.	Description demonstrates knowledge of the subject matter and an understanding of the main aspects are demonstrated. Good understanding of the techniques is shown. Some detail in the description provided. Some reference to at least two of the design issues highlighted in the question.	Description demonstrates secure knowledge of the subject matter and a secure understanding of the main aspects are demonstrated. Clear understanding of the techniques is shown. Good detail in the description provided. Some reference to all three of the design issues highlighted in the question.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates will be expected explain why different communication techniques are suitable when communicating between the members of a design team highlighted. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Answers likely to include: **Market Researcher and Designer** • Market research data through face to face meeting • Spreadsheets or statistical data to support findings • Written or graphical evidence from focus groups etc. **Designer and Production Engineer** • Detailed CAD models • Exploded views to show assembly details and help to communicate assembly processes • Detailed scale drawings/CAD models of component parts to help with tooling and manufacture planning and costing for materials • Regular meetings with engineers and manufacturing specialists throughout the design process.	**6**	Candidates are to **explain the suitability of the communication techniques** chosen. Techniques should be suitable for the scenarios given. No marks awarded for generic statements about communication methods.

Question			Expected response	Max mark	Additional guidance
			Designer and Client • Refined presentation visuals including photo realistic CAD renderings • Advertising images showing the intended use, accentuating the positive aspects and features of the product. Needed to convince the customer (parent/carer) of the benefits for the child • More refined preliminary renderings to show the progress and track changes for client • Rapid prototype models, traditionally crafted models.		

Question	Expected response	Max mark	Additional guidance
0-2 marks	**3-4 marks**		**5-6 marks**
Vague explanation provided as to the suitability of communication techniques identified. Little reference to the scenarios provided in question. Communications between **one or more** groups have been considered.	Clear explanation provided as to the suitability of communication techniques identified. Communications between **two or more** groups have been considered.		Considered explanation provided as to the suitability of communication techniques identified. Clear reference to scenarios provided in question. Communications between **all three** groups have been considered.

Question			Expected response	Max mark	Additional guidance
3.	(a)		**ABS Casing** Demonstrates and understanding of environmental requirements, the need for the material to be waterproof, to withstand the pressures and temperature changes in diving. The need for strength to withstand bumps and knocks in normal use while diving. The need for dimensional stability to prevent leaks which could lead to failure. Need to be able to be injection moulded into the complex shape with integrated internal features. **Silicon rubber** Has ability to be a tight fit between the 2 halves of the product and the light housing to give a secure seal to prevent leaks. It is flexible enough to fill the gap between the casing completely. **Toughened glass** Is very transparent and performs well. Is tough enough to withstand knocks against the diver's equipment and any other hard or sharp edges on the boat or diving area. **Anodised Aluminium** Anodising aluminium allows colour to be added without adding paint or other coatings. Anodising thickens the oxidised layer to better protect against further oxidisation.	**3**	It is expected that candidates give extended explanations. **1 mark for each valid point explaining the suitability of the identified materials relating to the torch.** **No marks to be awarded for simply stating properties of the material.** **Maximum of 2 marks for any 1 material.**

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates will be expected to have described features that have been incorporated into products to ensure their ease of assembly. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Answers likely to include: • Location pins • Bosses • Bayonet fittings • Asymmetric standard components • Symmetrical casings • Labelled/numbered parts • Self assembly features	**5**	To be put in the top banding candidates must have used sketches to illustrate their answer. Marks should be awarded where candidates have described how features they have identified have been incorporated to aid assembly. This could include internal features or knock down fittings.

			0-1	**2-3**	**4-5**
			Description demonstrates a limited knowledge and understanding of the subject matter. Limited understanding is shown of the features used to ease assembly. Vague descriptions lacking detail.	Description demonstrates knowledge of the subject matter and an understanding of the main aspects are demonstrated. Good understanding is shown of the features used to ease assembly. Some detail is provided. Reference to at least two features used to ease assembly.	Description demonstrates knowledge of the subject matter and a secure understanding of the main aspects are demonstrated. Clear understanding is shown of the features used to ease assembly. Good detail is provided. Reference to features used to ease assembly.

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates will be expected to describe the advantages offered from 3D printing compared to traditional modelling techniques. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Advantages of 3D printing may include: • Allows better communication of the concept with production engineers because 3D printing can utilise CAD data • Allows, due to accuracy, testing with other components and parts such as the lens housing and batteries • Quicker for complex models • Less labour intensive process than traditional modelling methods • Allows for a degree of repeatability which means incremental changes can be made to models as there is no interpretation or human error • Can use similar mechanically performing materials • Can speed up production because the CAD data can also be used by production engineers	**3**	Marks should be awarded using the best fit characteristics shown below. Marks will not be awarded for answers simply stating 3D printing is quicker and more accurate. Answer must **compare** 3D printing to traditional methods.

Question	Expected response	Max mark	Additional guidance

0-1 mark	2 marks	3 marks
Vague description of advantages offered from 3D printing compared to traditional modelling.	Clear description of advantages compared to traditional modelling.	Detailed description of advantages compared to traditional modelling.

Question			Expected response	Max mark	Additional guidance
4.	(a)		Candidates will be expected to describe the benefits of: • Using new technologies in the products • Using changes in consumer demand in the products Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Answers likely to include: • Maintain consumer interest • Increased market share • Enhanced reputation • Less investment in research and development • Reduced risk incorporating technologies developed in other fields • Focussed research and development • Less marketing as demand is established • Consumer gets what they want	**4**	1 mark for each valid statement. Max 3 marks for each approach.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates will be expected to describe the risk associated with launching a new product. Potential risks may include: • Time to market (takes too long, beaten to market by competitors) • Technology reliability (early versions perform poorly in terms of reliability, lower sales due to negative feedback) • Marketing and advertising (lack of advertising or ineffective marketing- wrong audience) • Quality of product (overall a poor product) • Reliability of product (early failures due to poor manufacture/assembly can lead to poor sales/ poor build quality an issue in early reviews) • Potential unforeseen IPR challenges from other companies	**4**	**1 mark** for each valid point leading to a clear description of the risk associated with launching a new product. **Maximum of 4 marks.**

Question			Expected response	Max mark	Additional guidance
5.	(a)		Candidates will be expected describe how ergonomics and the conditions of use may have influenced the development of The Shield Extinguisher. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Descriptions of influences could include: **Ergonomics** • Handle sizes and location need to be easy to access • Looks recognisable • Intuitive to operate • Height of product to allow it to be held and used effectively **Conditions in which it used** • Fire in the environment has influenced the shield shape • The need to protect the user influenced the shape and size • The need to be used in a hazardous emergency situation influenced the easy to locate handles • Emergency situation influenced the fire extinguisher red colour • Materials would have to be suitable Any other suitable answer		In order to gain full marks, candidates must consider **both** ergonomics and conditions in which it is used. Answers must reference the Shield Extinguisher.

Question	Expected response	Max mark	Additional guidance

0-1 mark	2-3 marks	4-5 marks
Limited understanding of the influence of ergonomics **and/or** conditions of use on the product. Vague reference to aspects of the product.	Good understanding of the influence of ergonomics **and/or** conditions in which it is used on the product. Reference to aspects of the product.	Clear understanding of the influence of ergonomics **and** conditions in which it is used on the product. Considered reference to aspects of the product.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates will be expected describe how a company could ensure their products are **manufactured** to the highest standard. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Responses could include: • Effective investment in early development • Consultation with outside experts • Effective quality control of material • Sampling and testing product during manufacture • Training staff • Motivating staff • Maintain machinery Any other suitable response	**4**	

0-2 marks	**3-4 marks**
Candidate shows a basic understanding of how a company can ensure their products are manufactured to the highest standards. One or more methods of ensuring products are produced to the highest standard have been considered.	Clear understanding demonstrated of how a company can ensure their products are manufactured to the highest standards. Two or more methods of ensuring products are produced to the highest standard have been considered.

Question			Expected response	Max mark	Additional guidance
6.	(a)		Candidates will be expected to describe the **key stages** of questionnaires and user trips which would ensure appropriate information was gathered. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. Responses could include: Description of the stages of questionnaires and user trips specific to this kind of product for blind people. **Questionnaire** • Clearly identifying the information to be gathered • Identifying suitable questions • Refining of questions to be asked • Adding control questions • Identifying a suitable spread of people to ask • Ensuring the questionnaire is in an accessible format for blind people • Identifying ways to distribute questionnaire and ways to ensure useful numbers are returned • Distributing and collecting/gathering • Collating the data from the questionnaire • Converting into useful formats (charts/graphs) **User trip** • Identify methods to simulate blindness • Consult blind people to identify specific areas where improvements are needed • Design tasks to carry out related to the identified areas • Analyse the findings and present a summary	**5**	No marks will be awarded for simply describing the information gained from questionnaires and user trips. Answers must describe the key stages required to carry out an effective questionnaire and user trip.

Question			Expected response	Max mark	Additional guidance
			Responses could include: Description of the stages of questionnaires and user trips specific to this kind of product for blind people. **Questionnaire** • Clearly identifying the information to be gathered • Identifying suitable questions • Refining of questions to be asked • Adding control questions • Identifying a suitable spread of people to ask • Ensuring the questionnaire is in an accessible format for blind people • Identifying ways to distribute questionnaire and ways to ensure useful numbers are returned • Distributing and collecting/gathering • Collating the data from the questionnaire • Converting into useful formats (charts/graphs) **User trip** • Identify methods to simulate blindness • Consult blind people to identify specific areas where improvements are needed • Design tasks to carry out related to the identified areas • Analyse the findings and present a summary		

Question			Expected response		Max mark	Additional guidance
			0-1 marks	**2-3 marks**		**4-5 marks**
			Responses demonstrate a limited understanding of the key stages of questionnaires **and/or** user trips. Largely generic comments, lacking in detail, not suitable for identifying the problem.	Responses demonstrate a good understanding of the key stages of questionnaires **and/or** user trips. Some details are given in the descriptions of the key stages that are relevant to identifying the problem.		Responses demonstrate a clear understanding of the key stages of questionnaires **and** user trips. Descriptions are clear and have details specific to identifying the problem.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates will be expected describe how the problems associated with manufacturing high-tech products in small numbers may be overcome. Although there is an underlying body of design knowledge required to answer it, there is a wide range of possible answers. The question is therefore marked holistically. The features which are looked for are knowledge of the subject matter, ability to comprehend the question and to construct an answer which uses clear examples to support the points made. **Responses may include:** • Seeking financial support through sponsorship • Consult experts in the early stages to minimise redesigns and wasted time to decrease initial costs • Outsource parts of the design process for efficiency • Outsource manufacturing • Buy in tried and tested technology or components • Use of flexible manufacturing techniques • Use of rapid manufacture	**5**	

Question	Expected response	Max mark	Additional guidance
0-1	**2-3**		**4-5**
Description demonstrates a limited knowledge and understanding of the subject matter. Vague descriptions lacking detail.	Description demonstrates knowledge of the subject matter and an understanding of the main aspects are demonstrated. Understanding is shown how the problems associated with manufacturing high-tech products in small numbers may be overcome. Some detail in the description provided.		Description demonstrates knowledge of the subject matter and a secure understanding of the main aspects are demonstrated. Clear understanding is shown of how the problems associated with manufacturing high-tech products in small numbers may be overcome.

[END OF MARKING INSTRUCTIONS]