National
Qualifications
2023

2023 Design and Manufacture

Advanced Higher

Finalised Marking Instructions

General marking principles for Advanced Higher Design and Manufacture

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If a 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.

(c) Where a question asks a candidate to **describe**, they must provide a statement or structure of characteristics and/or features. This should be more than an outline or a list. It may refer to, for example, a concept, process, experiment, situation, or facts, in the context of and appropriate to the question.

(d) Where a question asks candidates to **explain**, they must relate cause and effect and/or make relationships between things clear, in the context of the question or a specific area within the question.

Marking instructions for each question

Section 1

Question			Expected response	Max mark	Additional guidance
1.	(a)		Candidates are expected to identify a commercial product(s) they had analysed and outline the features of parts of the product(s) that enabled them to identify the processes that had been used in their manufacture **and** explain why these processes were suitable. Answers are likely to make reference to: • die cast/injection moulding – split • lines, injection/ejection points, complexity, surface detail etc • pierced – sheet material, shear marks material removed from the centre. And reasons for suitability such as: • complexity of shape, form and number produced.	**4**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below. Answer must relate to a product they have analysed.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Candidate demonstrates limited knowledge and understanding of the subject matter in identifying specific processes. • limited outline of identifying features • limited reasons for suitability of processes • general reference is made to product(s) • few valid points are made • it does not address the question — in this case 0 marks should be awarded.	**Candidate demonstrates knowledge and understanding of the subject matter in identifying specific processes.** • outline of identifying features • reasons for suitability of processes • reference is made to product(s) • a number of valid points are made.	**Candidate demonstrates sound knowledge and understanding of the subject matter in identifying specific processes.** • clear outline of identifying features • clear reasons for suitability of processes • clear reference is made to product(s) • a good number of valid points are made.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to identify a commercial product(s) they had analysed and describe how the materials and assembly methods used in the manufacture of the product(s) could impact the environment and society. Answers are likely to make reference to: • ease of maintenance, ability to recycle, recycled, designed for disassembly, permanent/ non-permanent bonds, durability/longevity, joining of similar and dissimilar materials, automated assembly (impact on work force), availability of products, mass production.	**4**	This question is set to test the candidates' knowledge and understanding from their analysis of the commercial manufacture of a product(s) and its impact on environment and society. Answer must relate to a product they have analysed. Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 – 1	**2 – 3**	4
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic description of the impact the product(s) materials have on the environment and society • limited or generic description of the impact the product(s) assembly method(s) have on the environment and society • there is reference to impact on environment and society.	**Answer demonstrates knowledge and understanding of the subject matter.** • some description of the impact the product(s) materials have on the environment and society • some description of the impact the product(s) assembly method(s) have on the environment and society • there is reference to impact on environment and society.	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed description of the impact the product(s) materials have on the environment and society • detailed description of the impact the product(s) assembly method(s) have on the environment and society • there is reference to impact on environment and society.

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to identify a commercial product(s) they had analysed and describe how they evaluated the product(s) **and** outline key points from their findings. Answers are likely to make reference to: • method of evaluation – jig, test, trial, comparison to other product(s), etc. and key findings.	**5**	Answer must relate to a product they have analysed. Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 – 2	**3 – 4**	**5**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic description of how they evaluated the product • key findings are unclear or limited.	**Answer demonstrates knowledge and understanding of the subject matter.** • some description of how they evaluated the product • key points from their findings are outlined.	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed description of how they evaluated the product • key points from their findings are clearly outlined.

Question			Expected response	Max mark	Additional guidance
	(d)		Candidates are expected to identify a commercial product(s) they have analysed and discuss the suitability of a production system(s) that could have been used in the manufacture of the product(s). Answers are likely to make reference to: • mass, batch, job, flow, JIT, etc.	**2**	Answer must relate to a product they have analysed. **1 mark** per valid point up to **a maximum of 2 marks**.

Question			Expected response	Max mark	Additional guidance
2.	(a)		Candidates are expected to identify a commercial product(s) they have researched and identify and describe how changes in society have influenced the evolution of the product(s). Answers are likely to make reference to: • any change in society and resulting change in product to match.	**5**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 – 2	**3 – 4**	**5**
Answer demonstrates limited knowledge and understanding of the subject matter. • a change in society is not clearly identified • limited or generic description of how the change in society has influenced the evolution of a product(s) they have studied.	**Answer demonstrates knowledge and understanding of the subject matter.** • a change in society is identified • description of how the change in society has influenced the evolution of a product(s) they have studied.	**Answer demonstrates good knowledge and understanding of the subject matter.** • a change in society is clearly identified • detailed or clear description of how the change in society has influenced the evolution of a product(s) they have studied.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to identify a commercial product(s) they have researched and describe key changes which occurred during the evolution of the product(s). Answers are likely to make reference to: • reasons that led to each change other than changes in society • when the changes occurred • reasons these changes were failures or successes.	**6**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 2	**3 — 4**	**5 — 6**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited/no description of key changes which occurred during the evolution of a product(s).	**Answer demonstrates knowledge and understanding of the subject matter.** • some description of key changes which occurred during the evolution of a product(s).	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed description of key changes which occurred during the evolution of a product(s).

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to identify a commercial product(s) they have researched and describe the work of a designer or company they are familiar with **and** how they have contributed to the evolution of the product(s). Answers are likely to make reference to: • a description of a key product • key features of the designer's or company's work • how these features influenced other products.	**4**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic description of the work of a designer or company they are familiar with • limited or generic description of how they have contributed to the evolution of products.	**Answer demonstrates knowledge and understanding of the subject matter.** • some description of the work of a designer or company they are familiar with • some description of how they have contributed to the evolution of products.	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed description of the work of a designer or company they are familiar with • detailed description of how they have contributed to the evolution of products.

Section 2

Question			Expected response	Max mark	Additional guidance
3.	(a)		Candidates are expected to explain the importance of defining a clear brief and specification before developing products such as the Air Pocket. Answers are likely to make reference to: • clear understanding of the problem issues with closed/open briefs • importance of requirements for specification • need to carry out effective research • risk to life • meet the needs/requirements • not waste time, money.	**4**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic reference to defining a clear brief and specifications • limited or no reference to developing products like the Air Pocket.	**Answer demonstrates knowledge and understanding of the subject matter.** • some explanation of the importance of defining a clear brief and specification • reference to developing products like the Air Pocket.	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed explanation of the importance of defining a clear brief and specification • clear reference to developing products like the Air Pocket.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to discuss the issues that may have influenced the selection of materials for the Air Pocket. Answers are likely to make reference to: • environment • function • cost.	**4**	**1 mark** per valid point.
	(c)		Candidates are expected to identify **two** marketing techniques that could be used to reach this target market **and** explain why they are suitable. Answers are likely to make reference to • targeted advertising in specialist journals • professionals – demonstrations • social media – use of targeted algorithms, etc.	**4**	**A maximum 3 marks** per marketing technique. Marketing techniques must be suitable for the **Air Pocket.**

Question			Expected response	Max mark	Additional guidance
4.	(a)		Candidates are expected to discuss the benefits and drawbacks of different idea generation techniques for developing ideas for products such as the Monofin. Answers are likely to make reference to: • biomimicry — movement • pencil walk generates shapes • brainstorming — group think • analogy — functional • morphological — limited to same attributes — more aesthetic.	4	Do not award marks for generic descriptions of idea generation techniques. Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic reference to benefits and drawbacks of idea generation technique(s) • limited or no reference to generating ideas for the Monofin.	**Answer demonstrates knowledge and understanding of the subject matter.** • discussion of benefits and drawbacks of idea generation technique(s) • reference to generating ideas for the Monofin.	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed discussion of benefits and drawbacks of idea generation technique(s) • clear reference to generating ideas for the Monofin.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to explain why each process is suitable for the Monofin: • injection moulding • two-shot injection moulding. Answers are likely to make reference to: **Injection moulding:** • complexity, surface finish, accuracy, detail, wall thickness. **Two-shot:** • different colours, different properties/materials required, no need for assembly.	**4**	Do not award marks for generic descriptions of processes. **1 mark** per valid point. **A maximum 3 marks** per process.

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to outline ways in which the safety of the Monofin could be quality assured. Answers are likely to make reference to: • quality checks — materials, components, machinery • training and monitoring of staff • sampling and testing.	4	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic outline of ways in which to quality assure safety • limited reference to the Monofin.	**Answer demonstrates knowledge and understanding of the subject matter.** • outline of ways in which to quality assure safety • reference to the Monofin.	**Answer demonstrates good knowledge and understanding of the subject matter.** • clear and detailed outline of ways in which to quality assure safety • clear reference to the Monofin.

Question			Expected response	Max mark	Additional guidance
5.	(a)		Candidates are expected to explain how technology push **and** market pull may have led to the development of the sustainable basketball shoe. Answers are likely to make reference to: **Tech push:** • introduction of 3D Printing. **Market pull:** • modular • personalisation • adaptable • more sustainable • high tech • performance.	**4**	**A maximum of 3 marks** for explanation of technology push **or** market pull. Therefore, candidates need technology push **and** market pull to be awarded **4 marks**. No marks for generic descriptions of technology push and market pull.
	(b)		Candidates are expected to discuss the advantages of 3D printing in the design and manufacture of the outer shoe. Answers are likely to make reference to: • mouldless manufacture • manufacturing mobility/flexibility • low-cost tooling • minimal wastage • suitable for bespoke or one-off production.	**4**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or generic discussion of advantages 3D printing • limited or no reference to the outer shoe.	**Answer demonstrates knowledge and understanding of the subject matter.** • discussion of advantages 3D printing • reference to the outer shoe.	**Answer demonstrates good knowledge and understanding of the subject matter.** • clear discussion of advantages 3D printing • clear reference to the outer shoe.

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to discuss the issues that may delay a product coming to market. Answers are likely to make reference to: • unreliable technology • research and development • lack of expertise • funding.	**3**	**1 mark** per valid point.

Question			Expected response	Max mark	Additional guidance
	(d)		Candidates are expected to outline the potential risks for designers and manufacturers of launching a radical product and explain how they may be overcome. Answers are likely to make reference to: **Risk:** • lower than expected sales • market doesn't accept radical product • market doesn't trust new approach or technology • consumers' buying patterns need changed • new technology might fail • radical products could damage reputation • product might fail and lose market share. **Methods to overcome:** • informative advertising campaign • endorsements • branding.	**4**	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates a limited knowledge and understanding of the subject matter. • vague outline of risks of launching radical products • vague/little reference to strategies for reducing risk of launching radical products • detail is limited.	**Answer demonstrates knowledge of the subject matter and an understanding of the main aspects.** • outline of risks of launching radical products • reference to a method(s) for reducing risk of launching radical products • detail is effective.	**Answer demonstrates good knowledge of the subject matter and an understanding of the main aspects.** • clear outline of risks of launching radical products • reference to method(s) for reducing risk of launching radical products • detail is highly effective.

Question			Expected response	Max mark	Additional guidance
6.	(a)		Candidates are expected to describe how physiology and psychology may have influenced the design of the 'The-O'. Answers are likely to make reference to: **Physiology:** • strength to lift influenced material choice • strength needed to turn pedals influenced material choice, seat position • user comfort; being able to use as seat and exercise bike comfortably. **Psychology:** • has to offer impression of stability and safety • has to fit in with common furniture design.	**4**	This question is set to assess the candidates' knowledge and understanding of how physiology and psychology may have influenced the design of the Pod. **1 mark** per valid description up to a **maximum of 4. A maximum of 3 marks** for physiology and psychology.

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to describe the conflicts which may have risen between ergonomics, performance and aesthetics when 'The-O' was being developed. Answers are likely to make reference to: • size to ensure comfort in pedalling Impact the aesthetic and performance • material selection • seat and shelf.	4	Although there is an underlying body of design knowledge required to answer it there is a range of possible answers. The question is therefore marked holistically. The features 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. Marks should be given using the best fit to the characteristics shown below.

An answer which falls into these categories may do so for a number of reasons. It is likely that:		
0 — 1	**2 — 3**	**4**
Answer demonstrates limited knowledge and understanding of the subject matter. • limited or no discussion on balance between ergonomics, performance and aesthetics for 'The-O' exercise bike.	**Answer demonstrates knowledge and understanding of the subject matter.** • discussion on balance between ergonomics, performance and aesthetics for 'The-O' exercise bike.	**Answer demonstrates good knowledge and understanding of the subject matter.** • detailed discussion on balance between ergonomics, performance and aesthetics for 'The-O' exercise bike.

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to outline **three** features designers need to consider to ensure components can be successfully die-cast. Answers are likely to make reference to: • maintaining consistent wall thickness • avoiding rapid changes in cross section • position of ejector marks and injection point • split line position • avoiding sharp corners and edges • outside corners with large radii • inside corners with fillets • radius in transitions • placement of undercuts • post-machining and surface finishing.	**3**	**1 mark** per valid point.

[END OF MARKING INSTRUCTIONS]