National
Qualifications
2025

2025 Design and Manufacture

Higher

Question Paper Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

General marking principles for 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) The term 'or any other valid response' allows for possible variation in candidates' responses. Always award marks according to the accuracy and relevance of an answer.

(d) 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.

(e) 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.

(f) Where a question asks candidates to **discuss**, they 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)		Candidates' explanations should relate to the materials chosen for these products and/or their component parts. **Explanations are likely to include:** **Medical trolley** **Stainless steel shelves and tubular frame:** • corrosion resistant • ductile/malleable • tough/impact resistance (knocks and bumps) • durable, withstands wear and tear • strength (hold weight of medical equipment) • chemical resistant • tubular steel reduces weight for pushing when loaded (frame only) • aesthetic qualities **Nylon Caster Wheels:** • self-lubricating (prevent sticking/run freely) • variety of colours • chemical resistance • durable, withstands wear and tear	**6**	**Six** valid explanations at **1 mark** each. **0 marks** awarded for repetition of properties, benefits or characteristics. Candidate's explanations must include the properties or benefits of the materials in relation to the trolleys. To achieve marks for lightweight/reduced weight, reference must be made to being tubular or hollow. If candidate refers to a finish on the mild steel, marks may be awarded for reference to preventing corrosion and chemical resistance. **Exemplar response:** *Stainless steel is suitable for the shelves of the medical trolley as is can be chemically cleaned and sterilised to safely hold medical equipment.* ***(1 mark)*** *Galvanising the mild steel wheel brackets on the tool trolley makes them corrosion resistant.* ***(1 mark)***

Question			Expected response	Max mark	Additional guidance
			Tool Trolley **ABS shelves and handles:** • chemical resistance • durable, withstands wear and tear • scratch resistant (maintains aesthetic look) • tough/impact resistance (knocks and bumps) • lightweight (portability) **Mild steel side panels and galvanised mild steel wheel brackets:** • durable, withstands wear and tear • ductile/malleable • good strength/rigidity to withstand the weight of tools and equipment • galvanising resists corrosion (wheel brackets only) • chemical resistant (galvanised wheel brackets only) • scratch resistant (maintains aesthetic look) **Polypropylene tool hooks:** • durable, withstands wear and tear • tough/impact resistance (knocks and bumps) • chemical resistance • variety of colours		

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to name and explain why the manufacturing processes are appropriate to the production of the trolleys. **Explanations are likely to include:** **Medical Trolley:** • extrusion of tubular stainless steel • bending tubular frame • piercing to provide holes for assembly • press forming of shelves • drawing of support rods • use of jigs in assembly • injection moulding of nylon wheels. (accept compression moulding) **Tool Trolley:** • painting or dip/powder coating of side panels • press forming for side panels • piercing of holes in side panels • injection moulding of polypropylene tool hooks • injection moulding of abs shelves and handles • press forming of wheel brackets **Explanations could include:** • repeatability of process • accuracy of process • economies of scale (mass/batch) • shape/form is suitable for process	**6**	Any **three** appropriate mass manufacturing processes and their relationships regarding suitability explained. **Maximum of 3 marks** for naming of processes, when related to part of product. (**1 mark** each process) **Maximum of 3 marks** for explanations of suitability. **1 mark** for each explanation of suitability; where more than one explanation is given to a process, **a maximum of 2 marks** per process should be awarded. **NB marks** can be awarded for correct explanation for the feature produced if an incorrect process is given. **Exemplar response:** *Galvanised mild steel wheel brackets have been die-cast **(0 marks, wrong process)** which is suitable because die casting is highly accurate (**1 mark, correct justification for press forming)**.* *Extrusion **(1 mark)** can be used to create the long circular shape **(1 mark)** of the stainless steel frame **(reference to part)**.*

Question			Expected response	Max mark	Additional guidance
			• surface finish/no further finishing required. • uniform cross section for extrusion • one piece construction of frame • intricate detail • process suitable to material form • sheet mild steel suitable for press forming • protection (painting or dip/powder coating only) • aesthetic reasons (painting or dip/powder coating only) • chemical resistant (painting or dip/powder coating only) **Any other suitable explanation.**		

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to describe how the design of the trolleys has been influenced by function. • handles to push trolley along • manoeuvrability • different compartments for different tools/accessories (tool trolley) • raised edges/support rails on medical trolley to stop items slipping off • use of standard components allows easy maintenance • material appropriate for medical use, easily cleaned hygienic (medical trolley) • tubular frame makes trolley light weight to manoeuvre even with equipment on it (medical trolley) • strength of construction/materials for holding tools etc (tool trolley) • four wheels for stability, stops trolley tipping over • self-assembly allows trolley to be dismantled for storage/repair/ replacement of parts (tool trolley) • Hooks for storing tools and equipment (tool trolley) **Any other suitable description.**	**5**	**Five** appropriate descriptions at **1 mark** each. **Exemplar responses:** *The primary function of the trolley is to be pushed around with ease **(0 marks)*** *The wheels allow for ease of turning in all directions **(1 mark)***

Question			Expected response	Max mark	Additional guidance
	(d)		Candidates are expected to explain the benefits **and** drawbacks of using standard components during the assembly of the trolleys. **Explanations are likely to include:** **Benefits:** • reduced costs (explained) • ensures consistency/less waste/improved Quality Assurance • ease of ordering (readily available) • enables JIT • standard sizes can simplify production process • greater flexibility in manufacture (can be used on other products) • ease of replacing for consumer • increase life span of product • no specialist tools required **Drawbacks:** • delivery issues • cost of outsourcing • reliability of supplier • quality assurance • sustainability issues **Any other suitable explanation.**	**4**	**Four** benefits/drawbacks at **1 mark** each. **Maximum of 3 marks** for each area **(3+1).** Candidates may refer to designers, manufacturers or consumers in their responses. **Exemplar responses:** *A benefit of using standard components is that they are readily available in mass quantities **(1 mark)**, as it will cost less to buy standard components than producing them. **(1 mark)*** *Consumers can assemble the trolley without the need for specialist tools **(1 mark)*** *A drawback of using standard components is that a manufacturer sources standard components, they must deal with a third party, which could have implications for delivery. **(1 mark)*** *The main drawback of standard components is that shipping time can throw off the production time resulting in more money being spent **(0 marks, no reference to reliability of supplier)***

Question			Expected response	Max mark	Additional guidance
	(e)		Candidates are expected to explain the benefits of using physical modelling in the design of products such as the trolleys. **Descriptions are likely to include:** **Sketch models:** • produced quickly to visualise ideas • check products scale (anthropometrics) • check functional issues, for example, stability etc • check operational issues, for example, levers, linkages, fitting parts • check aesthetic factors • development of initial ideas **Block models:** • communicate and develop form • test ergonomics • presented to a client • analyse the aesthetics of the design • surface detail • position of buttons etc **Test model:** • functional suitability/efficiency/performance • structural suitability • material performance • health and safety regulations • allow for alterations to be made pre-manufacture	**4**	**1 mark** for each valid description. Up to **2 marks** may be awarded for extended or detailed descriptions. Up to **a maximum of 4 marks.** **0 marks** should be awarded for simply naming model types. **0 marks** should be awarded for descriptions relating to computer generated models. Candidates do not need to name a model type. **Exemplar responses:** *For example, a miniature model **(ignore incorrect naming)** allows you to check the proportion using an ergonome. **(1 mark)*** *Physical modelling may also determine if the trolleys will hold up to the weight of the tools being stored **(1 mark)***

Question			Expected response	Max mark	Additional guidance
			Prototype: • test a fully working product/component • assist with marketing • provides clients with a fully working product (testing or promotion) • check for any flaws before actual production **Scale models:** • gather information on appropriate sizes • check the overall proportion • test ergonomics • check assembly methods **Any other valid description.**		

Section 2

Question			Expected response	Max mark	Additional guidance
2.	(a)		Candidates are expected to identify **one** thermoplastic that may have been used in the manufacture of the safety helmet **and** explain why it is suitable. **Responses are likely to include:** **Material Selection** **Outer shell:** • ABS, polypropylene, HIPS **Inner shell:** • Polystyrene, expanded polystyrene **Strap:** • Nylon, polypropylene **Buckle:** • ABS, Polypropylene **Explanations are likely to include:** **Outer shell:** • range of colours available • good impact resistance • scratch resistant • chemical resistance/easy to clean • suitable for outdoor/weather conditions	**3**	**Maximum 1 mark** for identification of a suitable material. **Two** valid explanations at **1 mark** each**.** Candidates do not need to relate the material to a specific part of the product. **Exemplar responses:** *HIPS **(1 mark)** has been used as it has a high resistance to impact, keeping the head safe **(1 mark)**, it is also available in different colours to appeal to children **(1 mark)**.*

Question			Expected response	Max mark	Additional guidance
			Inner shell: • lightweight • absorbs impact • available in a range of colours • provides ventilation **Strap:** • durable, resistant to wear • flexible • strong • chemical resistance for cleaning • excellent abrasion resistance **Buckle:** • range of colours available • good impact resistance • scratch resistant (ABS) • chemical resistance/easy to clean • suitable for outdoor/weather conditions • flexible (explained) **Any other suitable explanation.**		

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates are expected to explain how the needs of the target market may have influenced the design of products such as children's safety helmets. **Responses are likely to include:** • fit of inner shell around head • protect child's head • comfort of strap and buckle • weight of helmet for extended periods of wear • availability of different colours and patterns • current trends (movies, toys, TV, gaming) • different head sizes (adjustments can be made to fit) • air vents for comfort (sweating) **Any other suitable explanation.**	**4**	**1 mark** for each explanation of how it has been affected by the target market. **2 marks** for an extended answer. **Exemplar responses:** *The helmet must be adjustable to ensure it fits different head sizes **(1 mark)** and it must be comfortable as it may be used for a long period of time. **(1 mark)***

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to describe an evaluation technique that could be used to ensure the safety helmet is fit for purpose. **Techniques used:** • test rig • simulation testing • user trial (not for safety) **Responses for the descriptions are likely to include:** • testing ease of use (putting on, taking off, adjusting strap/tightness) • testing rigour of construction (using drop test/crash test, etc) • testing ergonomic issues (comfort, fit, etc) • testing functional issues (crash tests, adjustability) **Any other suitable description.**	**2**	**Two** valid descriptions at **1 mark** each**.** **2 marks** may be awarded for an extended description. **No marks** should be awarded for simply naming an evaluation technique. **Exemplar responses:** *A crash simulation would include using the helmet on a dummy and simulating a crash or fall **(1 mark)** to see how the helmets materials and overall shape and design responds. **(1 mark)**.*

Question			Expected response	Max mark	Additional guidance
3.	(a)		Candidates are expected to describe one advantage **and** one disadvantage of an open brief. **Advantage:** • an open brief would give the designer more creative freedom • an open brief would enable the possibility of more innovative ideas **Disadvantage:** • an open brief could lead the designer to produce designs that are unsuitable • an open brief may not give the designer enough information to fully understand client needs **Any other suitable description.**	**2**	**One** advantage and **one** disadvantage at **1 mark** each. Must include **one** advantage and **one** disadvantage. **Exemplar responses:** *A disadvantage of an open brief is that the designers could design a product that isn't what the client wanted **(1 mark)*** *A disadvantage of an open brief is that the designers could design a product that isn't what the client likes **(0 marks)***
	(b)		Candidates are expected to describe the purpose of the product design specification **and** outline the types of information it may contain. **Product design specification purpose:** • defines specific parameters • summarises the design brief and research • provides direction to the design process • used to evaluate changes in decisions **Any other suitable description.**	**3**	**1 mark** for correct description of purpose of specification. Up to **2 marks** for the example of types of information it may contain. **Exemplar responses:** **Purpose** *The purpose of a design specification is to guide the designer and keep them on the right path. **(1 mark)*** **Information contained** *The specification tells the designer the products function **(1 mark)** it also provides information from research such as the target audience. **(1 mark)***

Question			Expected response	Max mark	Additional guidance
			Type of information it may contain: • intended function • intended aesthetic appeal • intended ergonomic aspects • intended target market/user • min/max sizes • volume required **Any other suitable answer.**		
	(c)		The candidate is expected to outline key stages of an idea generation technique and explain why it would be used to help produce initial ideas. **Responses are likely to make reference to the key stages of:** • brainstorming • morphological analysis • analogy (tech. transfer/biomimicry) • lifestyle/mood board **Used to help:** • when designer runs dry of ideas • creativity • increase volume of ideas • diversity of ideas **Any other valid description.**	**3**	**No marks** awarded for naming a technique. Candidates must refer to key stages **(max 2 marks)** and explain why they are used **(max 1 mark)** to gain full marks. **Exemplar responses:** **Key stages** *Brainstorming is when a group sits in a circle with a sheet of paper in the middle and they say ideas in turn **(1 mark)**. Someone writes it down and they only stop when they run out of ideas. **(1 mark)*** ***Used to help*** *This helps to provide a lot of initial ideas **(1 mark)***

Question			Expected response	Max mark	Additional guidance
	(d)		Candidates are expected to describe how graphic techniques are used to communicate during the design process. Responses are likely to include the following graphic techniques. **Descriptions are likely to include:** **Sketches**: • used to quickly produce ideas • gets ideas on to a page quickly • gives a starting point for development • used to quickly explore ideas **Pictorial drawings:** • give more detail • can give realistic proportions • used to further explore and develop ideas • can help with problem solving • helps show overall product **CAD:** • can show realistic materials/finishes • can give a highly realistic view	**4**	**1 mark** for each valid description. Up to **2 marks** may be awarded for extended or detailed descriptions. Up to **a maximum of 4 marks.** **0 marks** should be awarded for simply naming graphic types. Candidates do not need to name a graphic type to be awarded marks. **Exemplar responses:** *Isometrics are often used for their accuracy and proportion **(1 mark)*** *Graphics drawings are a quick way to get some initial ideas at the start of the design process. **(1 mark)***

Question			Expected response	Max mark	Additional guidance
			Sectional views: • used to show internal details/components • can show assembly details helps manufactures to understand assembly **Exploded views:** • gives detailed understanding of assembly • can be used to explore how components fit together **Working drawings:** • exact measurements given • tolerances • surface finishes • parts list • production materials shown • production methods shown • assembly information **Any other valid description.**		

Question			Expected response	Max mark	Additional guidance
4.	(a)		Candidates must describe marketing techniques that could be used ensure the successful launch of a product. **Descriptions are likely to be taken from:** • celebrity endorsement • give aways/free accessories • reduced initial price • BOGOF deals • adverts on TV/radio/social media • use of social media influencers to promote/do reviews • effective branding • launch competitions • throw a launch party • product placement in TV shows/movies **Any other suitable description.**	**4**	**Four** appropriate descriptions at **1 mark** each. **Exemplar responses:** *TV adverts could be used as they would reach a lot of people **(1 mark)** and spread the news.* *Through word of mouth, this means that customers would tell other people they know of the products. **(0 marks)*** *The company could use billboards near motorways to promote the product ensuring potential users will see it **(1 mark)***
	(b)		Candidates are expected to describe steps that companies may take to delay the decline in product sales. **Descriptions are likely to be taken from:** • rebranding • increase advertising • reduce price • special offers (for example gifts, bundles) • updated versions (software) • special editions/additional features **Any other suitable description.**	**2**	**Two** appropriate descriptions at **1 mark** each. **Exemplar responses:** *Adding a rebrand of the packaging can create a new hype on the product meaning customers want to buy, increasing the sales. **(1 mark)***

Question			Expected response	Max mark	Additional guidance
5.	(a)		Candidates are expected to describe how ergonomics has influenced the design of the air fryer. **Descriptions are likely to include:** **Anthropometrics:** • the size of the handle – hand grip for diameter and hand width for length of handle • the size of the buttons – fingertip length and width **Physiology:** • weight of the air fryer for lifting in and out of cabinets for use (strength/strain) • weight of the basket when empty and full (strength/strain) • force required to push the buttons **Psychology:** • reassurance of seeing through the door • sounds/lights to indicate when buttons are pressed • ease of understanding the buttons/symbols **Any other suitable description.**	**6**	**Six** appropriate descriptions at **1 mark** each. Candidates must refer to all 3 areas of ergonomics to attract full marks. **A maximum of 4 marks** can be awarded for any single area **(4+1+1 or 3+2+1 or 2+2+2)** up to **a maximum of 6 total marks.** Candidates must relate an appropriate body part to a part of the product. **Do not** accept generic body parts, for example hand sizes, without clear description. Ignore incorrect percentile range, if given. **Exemplar responses:** *The handle of the door would have considered the average person's hand length so that it is not too big or too small to wrap your hand around **(1 mark)***

Question			Expected response	Max mark	Additional guidance
	(b)		Candidates must describe how the design of products has been influenced by market pull. **Descriptions are likely to include:** • need for accessibility • affordability • portability • improved quality (of product) • health/fitness tracking • aesthetics – colour/style options • mobile payments • e-tickets (transport etc) • online features • compatibility with existing products/previous version(s) of products **Any other suitable description.**	**2**	**Two** valid descriptions at **1 mark** each**.** **Do not** award marks for giving a definition of market pull. **Exemplar responses:** *Mobile phones to be smaller so they are more portable.* ***(1 mark)*** *The handheld vacuum cleaner was influenced by market pull as people needed lightweight and easily stored products* ***(1 mark)***

Question			Expected response	Max mark	Additional guidance
	(c)		The candidate is expected to outline the advantages of using intellectual property rights (IPR) to protect products. **Responses are likely to include:** • protection from theft • can take legal action • protects brand image • reputation protected • establish ownership • protects against loss of revenue/profits and market share for the company **Any other suitable response.**	**2**	**Two** explanations at **1 mark** each. No marks should be awarded for naming methods of IPR. **Exemplar responses:** *Intellectual property rights prevent design ideas from being stolen **(1 mark)**. Another advantage is that it can give a company exclusivity to a design so that they have no competition. **(1 mark)***

Question			Expected response	Max mark	Additional guidance
6.	(a)		Candidates are expected to describe different methods that could be used to identify different types of materials. **Descriptions are likely to include reference to:** • flame test (only if colour of flame or smell of smoke is mentioned) • testing for magnetism (ferrous metals) • float test (buoyancy/displacement) • scratch test • look for identification markings • drop test • cutting (looking for chips or slices) • smell/odour • colour/grain (wood only) • relative weight to a known material **Any other valid description.**	**4**	**Maximum of 3 marks** per method described**.** **Maximum of 3 marks** per material type**.** **0 marks** awarded for simply naming a technique. Marks can only be awarded for reference to material classifications (wood/metal/plastics) Methods should relate to appropriate materials, ie magnetism to metals. **Exemplar responses:** *A float test can be used to identify a material based on its buoyancy such as polystyrene that floats on water.* ***(1 mark)*** *A flame test can be used to identify a metal as it will produce a different coloured flame* ***(1 mark)****. Eg, copper burns with a green flame* ***(1 mark)***
	(b)		Candidates are expected to outline two identifying features of blow moulding. **Features identified are likely to include:** • hollow object • thin walls • high quality finish (mould dependant) • split lines • discolouration (due to stretching) **Any other valid response.**	**2**	**1 mark** for each identifying feature of blow moulding.

Question			Expected response	Max mark	Additional guidance
	(c)		Candidates are expected to describe how Gantt charts and Just-in-time (JIT) productions can be used in the development and manufacture of products. **Descriptions for Gantt charts may include:** • help staff know what they should be doing and when • reducing lead-time • reducing delays in purchasing of components • maximising output/less hours lost in production time • more efficient use of workforce/labour requirements • maximising efficient use of plant machinery • increase in quality assurance and control of production • increase in productivity • reducing stock wastage • reducing manufacturing costs • reduced labour costs **Descriptions for JIT may include:** • reducing lead-time • reducing purchase inventory/storage of component parts • reducing delays in purchasing of components • maximising output/less hours lost in production time • model diversification in assembly	**4**	**Four** appropriate descriptions at **1 mark** each. **3 + 1 or 2 + 2.** **Exemplar responses:** **Gantt Charts** *Gantt charts will be used in the manufacture of products to show time, workers and the order of work that needs to be done.* ***(1 mark)*** *It may also show deadlines of when a product must be finished.* ***(1 mark)*** **Just in Time** *JIT is when stock arrives when it is needed to prevent overflow in storage.* ***(1 mark)*** *This keeps the process flowing productively and helps to maintain good timekeeping.* ***(1 mark)***

Question			Expected response	Max mark	Additional guidance
			• maximising efficient use of plant machinery • structured planning of production • increase in quality assurance and control of production • increase in productivity • reducing stock wastage reducing manufacturing costs **Any other suitable description.**		

Question			Expected response	Max mark	Additional guidance
7.			Candidates are expected to describe how consideration for the environment has influenced the **design, manufacture, use** and **disposal** of products. **Descriptions are likely to make reference to some of the aspects below.** **Design:** • consideration of materials • obsolescence • minimise packaging • easily dismantled products • reduce number of parts • reduce number of materials • incorporate components that could be reused **Manufacture:** • efficient/innovative use of materials • use of 'green' materials • transportation issues (manufacture close to point of sale) • easily transported (lightweight/stackable) • waste management (minimise waste) • minimise packaging • efficient/innovative use of production and planning • using recyclable materials • labelling of plastic components to assist recycling	**8**	This question is set to test the candidate's ability to present a reasoned discussion about how designers consider environmental issues at all stages of a product's life. 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. 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. The table below is designed to assist with the placing of answers within the full mark range. Candidate should relate the points above to how they impact stages in a products life from design to disposal. Candidates do not need to refer to all stages in their answer to gain full marks.

Question			Expected response	Max mark	Additional guidance
			• use of recycled materials in the manufacture of the product. • efficient/innovative use of manufacturing processes/machinery • reduced volume of material used in each product • reduce number of manufacturing processes used **Use:** • obsolescence • easily dismantled products for maintenance • easily transported (lightweight/stackable) • reuse components • efficient in use ('A' rated products) • use of durable materials to increase lifespan of product **Disposal:** • use of 'green' materials • sustainability • up-cycling • obsolescence • waste management (minimise waste) • recyclable packaging • using recyclable materials • labelling of plastic components to assist recycling • easily dismantled products reuse components		

0 — 2 marks	3 — 4 marks	5 — 6 marks	7 — 8 marks
An answer which falls into this category may do so for a number of reasons. • **limited** knowledge or understanding of environmental issues • very few points are made • much of the response does not answer the question • the answer is simply too thin • limited reference is made to stages in a product's life	An answer which falls into this category may do so for a number of reasons. • **adequate** knowledge or understanding of environmental issues • the answer will be relevant to the question • some reference is made to stages in a product's life • although examples are used, some points made are unclear	An answer which falls into this category may do so for a number of reasons. • **secure** knowledge or understanding of environmental issues • the answer will be relevant to the question and demonstrate a good level of comprehension • reference is made to three or more stages in a product's life • most points made are clear and examples are used to support them	An answer which falls into this category may do so for a number of reasons. • **extensive** knowledge or understanding of environmental issues • the answer will be relevant to the question, demonstrating a high level of comprehension • clear connections are given between environmental aspects and multiple stages in a product's life • all points made are clear and examples are used to support them

[END OF MARKING INSTRUCTION]