National Qualifications

X819/75/01 Design and Manufacture

Marking Instruction

Please note that these marking instructions have not been standardised based on candidate responses. You may therefore need to agree within your centre how to consistently mark an item if a candidate response is not covered by the marking instructions.

General marking principles for National 5 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) To be awarded marks candidates must respond to the command word used in the question. For example, listing a valid point, even if correct, should not be awarded marks if the question asked for an outline, description or explanation.

(d) Mark consecutive responses to match the marks in 'name/state' questions. For example, if two responses are given to a 1 mark question, only the first response should be marked.

(e) Candidates must answer all aspects of the question to gain full marks. For example, if the questions require two reasons candidates must make two valid and substantiated points relating to the question to gain both marks. If the questions require three stages to be described, candidates must provide a structure of characteristics and/or features of each of the three stages to be awarded all 3 marks.

(f) 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 **name/state/complete**
Candidates must provide the answer in brief form/name. Candidates will normally be required to make the same number of statements as marks available in the question.

(ii) Questions that ask candidates to **outline**
Candidates must provide a brief sketch of content. More than naming, but not a detailed description. Candidates will normally be required to make the same number of actual/appropriate points as marks available in the question.

(iii) 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 marks available in the question.

(iv) 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.

Marking instructions for each question

Section 1

Question			Expected response	Max mark	Additional guidance
1.	(a)	(i)	Name the following • aluminium. **Any other suitable response.**	**1**	**1 mark** for correct response. Any other suitable response could include zinc, tin or nickel. Silver scores zero marks.
		(ii)	Name **one** of the following • mild steel • high-carbon steel • stainless steel • iron • cast iron. **Any other suitable response.**	**1**	**1 mark** for correct response.
	(b)		Description of how to dip coat the metal bar. Typical responses are likely to include reference to • heat metal in forge/oven etc. • suspend material in powder until evenly coated • hang up/leave to cool/set plastic coating • reheat in forge/oven to improve finish. **Any other suitable response.**	**2**	**1 mark** for each valid point or effective sketch leading to a clear description, up to a maximum of **2 marks.** *'Heat it up'* scores zero marks. *'Heat it up in forge/oven'* scores one mark. *'Leave it to cool'* scores one mark (does not reference a workshop tool but no additional tool/equipment required at this point).

Question			Expected response	Max mark	Additional guidance
	(c)	(i)	Outline any **two** safety checks on the centre lathe before use • guard down • bar secure in chuck • chuck key removed • material running true/centred • cutting tool centred • tail stock centre secure. **Any other suitable response.**	**2**	**1 mark** for each correct response up to a maximum of **2 marks**. Marks can only be awarded for checks on the centre lathe. No marks should be awarded for reference to personal safety or protective equipment. *'You must wear goggles'* scores zero marks. *'The guard'* scores zero marks. *'Put the guard down before use'* scores one mark. *'Put the guard down before use and make sure the work piece is secure'* scores two marks.
		(ii)	Name any **two** of the following • parallel • step turning • taper turning. **Any other suitable response.**	**2**	**1 mark** for each correct response up to a maximum of **2 marks**. Marks are also awarded for the following • facing of • chamfering (if taper turning has not already been awarded a mark) • parting off. References to threading score zero marks.

Question			Expected response	Max mark	Additional guidance
		(iii)	Description of how to create the finished cap. **Drilling Stage** • indent end of bar with centre drill • use scale on tailstock or indicate correct depth for drilling • create hole with twist drill. **Threading Stage** • select a clean/undamaged tap • use of cutting compound • use a tap to make the thread • accurate alignment • half turn forward, quarter turn back. **Any other suitable response.**	**3**	**1 mark** for each valid point or effective sketch leading to a clear description, up to a maximum of **3 marks.** Candidates can gain full marks by referring to only the drilling stage or only the threading stage. **1 mark** for valid point leading to a clear description. *'Drill a hole'* scores one mark. *'Tap the hole'* scores one mark. References to different types of tap attract a maximum of two marks. *'Tap the hole with a taper tap followed by a middle tap and then a plug tap'* scores two marks.
	(d)	(i)	State any **two** of the following • can be formed into shape required • polishes well • durable • can be drilled and cut to shape required • available in a range of colours. **Any other suitable response.**	**2**	**1 mark** for each correct response, up to a maximum of **2 marks**. *'Easy to work with'* scores one mark. *'Easy to use'* scores zero marks. This response is too vague. References to *'cheap'* score zero marks. Strength is not a relevant property for the pen holder, so read on. Due to wear and tear durability is a relevant property and can attract marks.
		(ii)	An outline that includes any of the following • place wood underneath plastic • clamp the acrylic securely • mask plastic before drilling • use stepped drill bit/use multiple drills • feed the drill through slowly • drill before forming curve. **Any other suitable response.**	**1**	**1 mark** for a correct response. *'Drill it slowly'* scores one mark. *'Clamp it'* scores one mark.

Question			Expected response	Max mark	Additional guidance
		(iii)	Description of how to form the curve accurately. Typical responses are likely to include reference to • heating plastic in oven • bend around a former • secure in place until it sets • leave to cool. **Any other suitable response.**	**3**	To be awarded marks candidates must provide a description when answering this question. **1 mark** for each valid point or effective sketch leading to a clear description, up to a maximum of **2 marks**. *'Heat it'* scores zero marks. *'Heat it in the oven'* scores one mark. Reference to heating in a vacuum former or thermoforming centre will score one mark. *'Bend it'* scores zero marks. *'Bend it around a piece of wood'* scores one mark (implies use of a former). *'Bend it around a piece of wood and clamp it in place'* scores two marks. *'Leave it to cool'* scores one mark (does not reference a workshop tool but no additional tool required at this point).

Question			Expected response	Max mark	Additional guidance
	(e)	(i)	A description and/or sketch that could include some of the following **Marking out stage** • measure the thickness of wood and mark from end of the other piece with a steel rule • draw lines at 90 degrees with try square • mark depth with marking gauge. **Cutting stage** • use a G-clamp to hold a guide piece of wood next to the line • cut the line to the required depth with a tenon saw • remove the waste wood with a chisel (naming a specific chisel is not required) • level the bottom of the joint with a chisel. There is no requirement to refer to the identified stages in the correct sequence. **Any other suitable response.**	**4**	**1 mark** for each valid point or effective sketch leading to a clear description, up to a maximum of **4 marks.** Candidates must refer to both the marking out and cutting stages to gain full marks. A maximum of **3 marks** may be awarded to responses that only refer to **one** of the stages. Responses that do not refer to appropriate tools score a maximum of **1 mark**. Candidates may use sketches to aid their descriptions. Lists of tools score zero marks for example 'use a saw and chisel'. 'Mark the distance with a ruler' scores zero marks (a ruler should be used to measure). References to clamping/securing in vice on its own scores zero marks. Basic statements such as 'mark the wood with a pencil' score zero marks. 'Mark the lines with a try square' scores one mark. References to sanding/filing the bottom of the joint score zero marks. References to levelling the lap joint with a router or rebate plane score one mark.
		(ii)	Name **one** of the following • red pine • spruce. **Any other suitable response.**	**1**	**1 mark** for correct response. Any other suitable response could include larch, cedar and douglas fir.

Question			Expected response	Max mark	Additional guidance
		(iii)	Outline any of the following • transparent so allows the wood grain to be seen • adds durability • gives shiny surface • easy to clean. **Any other suitable response.**	**2**	**1 mark** for each correct response, up to a maximum of **2 marks**. *'Easy/quick/cheap to apply'* is too vague so read on (unqualified quick/cheap/easy).
	(f)	(i)	A statement that covers the following • to only heat along a single line. **Any other suitable response.**	**1**	**1 mark** for correct response. *'It is quicker than using the oven'* scores zero marks. *'We don't have an oven'* scores zero marks as the question identifies an oven as a possibility.
		(ii)	An explanation that covers the following • stops the wood splitting • as a guide for the screw • so that the screw is easier to get in • ensures alignment when drilled through countersunk holes. **Any other suitable response.**	**2**	**1 mark** for each correct response, up to a maximum of **2 marks**. *'Ensures alignment'* scores zero marks unless referenced to existing countersunk holes.
		(iii)	A statement that covers the following • prevents scratches from the screw heads. **Any other suitable response.**	**1**	**1 mark** for a valid point leading to a clear explanation. '*So that the heads sit flush*' scores one mark.

Question			Expected response	Max mark	Additional guidance
		(iv)	An explanation that covers the following • the acrylic is unlikely to be thick enough to screw into • looks more attractive/don't see the screw heads • faster process as no need to create holes. **Any other suitable response.**	**2**	**1 mark** for each correct response, up to a maximum of **2 marks**. *'It is quick'* scores zero marks. *'It is quicker than using screws'* scores one mark. *'Gives a permanent join'* scores one mark. *'It easier to apply'* scores one mark. *'It is easy to use'* scores zero marks as this is too vague. *'It is easier to use than screws'* scores one mark.

Question			Expected response	Max mark	Additional guidance
2.	(a)	(i)	Outline must reference information gained about the chair from a user trip. Outline aspects of any of the following • ease of use • ergonomic feedback • how it works • how easy is it to clean. **Any other suitable response.**	**3**	**1 mark** for each correct response, up to a maximum of **3 marks**. To be awarded marks candidates must clearly refer to the chair when answering this question. *'User trips help you to understand the ergonomics of the chair'* scores zero marks as the reference to the chair is too vague. *'You can understand if it is easy to move the chair around on a carpet or wooden floor. Also, if the seat is comfortable for long term use'* scores two marks. *'Is it easy to understand how the levers work?'* scores one mark. *'The size of it'* scores one mark. *'How much it costs'* scores zero marks. *'How attractive the colours are'* scores zero marks. *'How strong it is'* scores zero marks.
		(ii)	Name the following • questionnaire • comparison to other products • user trial. **Any other suitable response.**	**1**	**1 mark** for correct response. Other suitable responses could include • consumer reviews • product testing • measuring and recording • using the internet/books/TV.
	(b)	(i)	Morphological analysis A description that refers to the following stages • identify a set of suitable parameters for the table heading • populate the rows with suitable attributes • choose combinations of attributes • generate ideas from results. **Any other suitable response.**	**3**	**1 mark** for each correct response, up to a maximum of **3 marks**. It is possible to gain three marks by drawing a morphological analysis table that highlights the bullet points to the left.

Question			Expected response	Max mark	Additional guidance
		(ii)	Name the following • Brainstorming. **Any other suitable response.**	**1**	**1 mark** for correct response. Candidates may also gain marks by referring to the following • taking your pencil for a walk • technology transfer • analogy/biomimicry • lateral thinking • SCAMPER • lifestyle board • moodboard. *'Existing products'* scores zero marks. *'Mind maps'* score zero marks as it is not an idea generation technique.
3.	(a)		An outline that includes **two** of the following • can be used to show alignment of parts • joining methods can be clearly shown • useful to show the number of parts **Any other suitable response.**	**2**	**1 mark** for each valid point up to a maximum of **2 marks**. Unqualified 'quick' and 'easy' responses score zero marks. *'You can see how it fits together'* scores one mark. *'You can get the sizes'* scores one mark as, although not displayed on the question graphic, this is possible.
	(b)		An outline that includes **two** of the following • sketches can be produced quickly which allows lots of ideas to be produced in a short time • communicates your idea visually • sketches can be used to explore/evolve • you are not limited or constrained by computer software • if mistakes are made they can be easily changed or discarded • ideas can emerge naturally • no specialist equipment is required. **Any other suitable response.**	**2**	**1 mark** for each valid point up to a maximum of **2 marks**. Unqualified *'easy'* responses scores zero marks. In the context of this question an unqualified *'quick'* is accepted. Example responses *'To see how it is put together'* scores one mark. *'Gives a rough idea of what it will look like'* scores one mark. *'Easy to change'* scores one mark.

Question			Expected response	Max mark	Additional guidance
4.			Outline of **four** pieces of information from the following • provides better understanding of 3D form. • to investigate if a slice of bread fits in the slots • if it would present any maintenance/cleaning issues • if the design is sturdy and stable • to evaluate aesthetics in a modern kitchen setting • physical interaction gives feedback on ergonomics • to present to a client for feedback. **Any other suitable response.**	**4**	**1 mark** for each valid point up to a maximum of **4 marks**. *'The size of the push levers can be checked to ensure that fit the size of fingers'* scores one mark. *'The block model shows lots of crumbs could get stuck in the grooves on the side panel'* scores one mark. *'To test it'* scores zero marks. *'The size of the levers/buttons'* scores one mark. *'The position of the levers/buttons'* scores one mark. *'The proportion compared to other kitchen items'* scores one mark. *'If the colours look good'* scores one mark (do not need to refer to block model of toaster).
5.	(a)		Description must reference how safety may have influenced the cooker. Typical responses could include reference to • the heat plate is red when hot • corners are rounded • flat surface on top of cooker provides a stable base • flat surface on top of cooker is easy to clean – hygienic • the temperature display indicates how hot the oven is • the dials indicate the heat of the rings • there is a light inside the oven so that you can see easily • the oven rack is silver making it easier to see and less likely to burn yourself on it • the door handle does not heat up. **Any other suitable response.**	**2**	**1 mark** for each valid point up to a maximum of **2 marks**. Different answers must be given in parts (a) and (b). *'The rings are red'* scores zero marks. *'The rings are red when hot'* scores one mark. *'The door is not too heavy in case it falls on you'* scores zero marks.

Question			Expected response	Max mark	Additional guidance
	(b)		Description must reference how ergonomics may have influenced the cooker. Typical responses could include reference to • the size of the handle to fit the hand • the size of the hand to fit the dials • the ease of turning/twisting the dials • the ease of opening the door • ease of moving the shelves • ease of reading the dials • ease of reading the display • ease of seeing through the door • the volume/tone of the timer so that it is easy to hear • the colour of the rings to show they are hot. **Any other suitable response.**	**4**	**1 mark** for each valid point up to a maximum of **4 marks**. Different answers must be given in parts (a) and (b). If candidates mix-up the different elements of ergonomics they can still gain marks. To gain marks, candidates should describe the relationship between the anthropometric consideration and part of the cooker. No marks for noting percentiles only, for example, '95th percentile' on its own scores zero marks. Candidates can still gain marks if they mix up percentiles. A list of cooker parts scores zero marks. No marks should be awarded for generic statements about anthropometrics. *'The size the handle'* scores zero *marks*. *'The size of the handle to fit the hand'* scores one mark. *'The dials should be easy to turn'* scores one mark. *'The door should be easy to open'* scores one mark. *'The numbers should be easy to see'* scores one mark.

Question			Expected response	Max mark	Additional guidance
	(c)		A description that includes **two** of the following • reduce materials • reduce number of parts • use recyclable materials • make the materials used easy to identify • reuse parts/all of the product • design for disassembly. **Any other suitable response.**	**2**	**1 mark** for each valid point leading to a clear description, up to a maximum of **2 marks**. Responses are not required to refer to the cooker however they must refer to the end of a products lifespan. *'Make products recyclable'* scores one mark. *'Designers must use materials which can be recycled once the product has been used. If the product can be taken apart easily then it will be easy to recycle' s*cores two marks.
6.			Describe how the tables compare aesthetically. Candidates should describe the comparison of the following areas of aesthetics • colour • shape • form • texture • line • proportion • symmetry • contrast • pattern • fashion. **Any other suitable response.**	**3**	**1 mark** per correct comparison up to a maximum of **3 marks.** To gain **1 mark** candidates should refer to one of the broad areas, link it to a table **and then compare** this feature to the other table. A list of aesthetic terms scores zero marks. *'Table A is silver'* scores zero marks. *'Table A is silver and table B is brown'* scores one mark. *'The silver colour on table A is in contrast with the natural wood tone of table B'* scores two marks (colour and contrast referenced). *'The curved lines of table A are different to the straight lines in table B.'* scores one mark. Basic descriptions can gain a mark *'Both tables have symmetrical shapes'* scores one mark.

Question			Expected response	Max mark	Additional guidance
7.	(a)		A description that includes any **one** of the following • trust in a brand name/reputation • guaranteed sales for manufacturer • self-promoting/advertising • premium pricing • customer loyalty • perception of a high-quality product well-known brands can influence sales. **Any other suitable response.**	**2**	**1 mark** for each valid point leading to a clear explanation, up to a maximum of **2 marks.** *'Well known so people are more likely to buy it'* scores one mark. *'If customers believe the brand produces high quality products then they are more likely to purchase an additional product produced by the same brand'* scores one mark.
	(b)		Description of market pull may include • consumer needs change resulting in new products being designed • customers asking for improvements to existing products resulting in product updates • other companies launch similar products to satisfy consumer demand. **Any other suitable response.**	**1**	**1 mark** for correct response. *'What people want to buy'* scores zero marks. *'Companies making products that people want to buy'* scores one mark as this references a reaction by a designer/manufacturer.

Section 2

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	Select a suitable material, from the list, for the drill bit • high carbon steel. State any appropriate property of high carbon steel • strength to withstand pushing force • resistant to wear/durable • high melting point • readily available • can be heat treated to improve hardness/toughness. **Any other suitable response.**	**2**	**1 mark** for correct material. **1 mark** for correct property. No mark for repetition of answer from 8(a)(ii). *'It's strong'* scores one mark. *'It's cheap'* scores zero marks.
		(ii)	Select a suitable material, from the list, for the drill casing • ABS. State any appropriate property of ABS • impact resistant • durable • suitable for injection moulding • scratch resistant • variety of colours • non-conductor of electricity • chemical resistant for cleaning • strong. **Any other suitable response.**	**2**	**1 mark** for correct material. **1 mark** for correct property. No mark for repetition of answer from 8(a)(i).
	(b)		State any **two** features of injection moulding • injection mark • ejector pin marks • good surface finish • complex/detailed shapes • accuracy • webs • bosses. **Any other suitable response.**	**2**	**1 mark** for each identified feature of injection moulding, up to a maximum of **2 marks**. *'Flat circles'* scores one mark as this infers ejector pin marks.

Question			Expected response	Max mark	Additional guidance
8.	(c)	(i)	**Tapered sides** • slope allows easy removal of pattern.	**1**	**1 mark** for correct manufacturing reason. *'Stops plastic sticking to pattern'* scores one mark.
		(ii)	**Rounded corners** • reduces risk of plastic tearing.	**1**	**1 mark** for correct manufacturing reason. *'Stops the material getting too thin at the corners'* scores one mark.
9.			Description of benefits of 3D printers in manufacture • models can be made with no craft skills • no need for workshops/tooling • faster than traditional prototyping methods • one off production economically possible • the process is fully automated • model can be created directly from CAD drawing • creates complex 3D models that are free from the restraints of traditional manufacturing techniques • accuracy of parts • reduces work force/wages as work is automated • increased efficiency as machines can run 24 hours a day • same or similar materials to the final product can be used • additive process so less waste material • no assembly as joints formed as part of 3D printed model. **Any other suitable response.**	**3**	**1 mark** for each benefit up to a maximum of **3 marks**. Responses relating directly to 3D printing of a prosthetic hand can gain marks. *'Would allow moveable finger joints to be created in the model'* scores one mark. Unqualified *'quick', 'cheap' or 'easy'* responses score zero marks. *'Quicker than by hand'* scores one mark.

Question			Expected response	Max mark	Additional guidance
10.			Description of the benefits of using knock-down fittings • reduces the cost of production • reduction in manufacturing costs can be passed on to the consumer making the furniture more affordable • furniture can be assembled in situ allowing large pieces of furniture to be fitted into smaller spaces • only simple tools required to assemble furniture for example screwdriver or Allan key • consistent quality of product • reduced need for skilled workforce • increased use of automation as parts and assembly can be simplified • avoids complex time-consuming joints • reduced space required for storage at factory. **Any other suitable response.**	**3**	**1 mark** for each valid point with a clear description, up to a maximum of **3 marks**. Unqualified *'quick', 'cheap' or 'easy'* responses score zero marks. *'Speeds up production process'* scores one mark. References to being easier to transport score zero marks as the question refers to the assembly of furniture rather its transportation.

Question			Expected response	Max mark	Additional guidance
11.	(a)		Description of how design and manufacturing technologies have had on the supply of products. Responses could include reference to • products are cheaper • a larger range of products available • products are more readily available/meets consumer demand • quality of product • throwaway culture. **Any other suitable response.**	**2**	To be awarded marks candidates must provide a description when answering this question. **1 mark** for each valid point with a clear description, up to a maximum of **2 marks**. No marks to be awarded for repetition within parts (a), (b) and (c). Candidates can gain marks by referring to positive or negative impacts. *'They are cheaper to buy'* scores one mark. *'You can get them anywhere' scores one mark.* References to the quality of the product improving or reducing can gain marks.
	(b)		Description of how design and manufacturing technologies have had an impact on the workforce. Responses could include reference to • unemployment • job availability for skilled workers • economic climate of area • some workers becoming deskilled • less labour-intensive jobs • reduction in work related injuries. **Any other suitable response.**	**2**	**1 mark** for each valid point with a clear description, up to a maximum of **2 marks**. Candidates can gain marks by referring to positive or negative impacts. No marks to be awarded for repetition within parts (a), (b) and (c).

Question			Expected response	Max mark	Additional guidance
	(c)		Description of how design and manufacturing technologies have had an impact on pollution. Responses could include reference to • changes in levels of air pollution created during manufacture of products • biodegradability of products/packaging • animal welfare • amount of waste in landfill/oceans • plastic contamination in the food chain due to animals consuming discarded plastic • aesthetic impact on beaches and in countryside. **Any other suitable response.**	**2**	**1 mark** for each valid point with a clear description, up to a maximum of **2 marks**. No marks to be awarded for repetition within parts (a), (b) and (c). Candidates can gain marks by referring to positive or negative impacts.

[END OF MARKING INSTRUCTIONS]