National
Qualifications
2023

# 2023 Design and Manufacture

# Higher

# 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**

| Question | | | Expected response | Max mark | Additional guidance |
|---|---|---|---|---|---|
| **1.** | (a) | | Candidates are expected to explain why the materials chosen are suitable for these parts.<br>**Explanations are likely to include:**<br>**Plastic coated/painted tubular mild steel frame:**<br>• durable, withstands wear and tear<br>• plastic coating/paint resists corrosion<br>• plastic coating/paint can be used to enhance aesthetics<br>• Lightweight (portability)<br>• ductile/malleable<br>• available in a variety of colours<br>• good strength/rigidity to withstand the weight of the user<br>• can be welded.<br>**Galvanised mild steel wheels:**<br>• corrosion resistant<br>• durable, withstands wear and tear<br>• aesthetic qualities<br>• chemical resistant (easy to clean).<br>**Polypropylene seat:**<br>• chemical resistance (easily cleaned)<br>• available in a variety of colours<br>• durable, withstands wear and tear<br>• tough/impact resistance.<br>**PVC steering wheel:**<br>• available in a variety of colours<br>• chemical resistance (easily cleaned)<br>• durable, withstands wear and tear. | **6** | **Six** valid explanations at **1 mark** each.<br>Candidates should give **six** different explanations.<br>Candidate's explanations should relate to the materials chosen for the go karts and/or their component parts.<br>They should include the properties or benefits of the materials related to this product.<br>Exemplar response:<br>**No marks** awarded for simply stating properties.<br>**No marks** awarded for repetition of explanations.<br>*ABS is a suitable material for the wheels as it is impact resistant, allowing it to withstand bumps. **(1 mark)***<br>*Solid textured polypropylene is a suitable material for the seat as it provides grip. **(0 marks, texture created during manufacture, not a property of material)***<br>*Polypropylene is a suitable material for the commercial go kart because it is easy to clean. **(0 marks)***<br>*Zinc is a good choice of material for the galvanising mild steel wheels as it stops them rusting. **(1 mark)***<br>*Polypropylene is tough meaning it can withstand impacts. **(1 mark)*** |

| Question | | | Expected response | Max mark | Additional guidance |
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| | | | **Hollow ABS wheels:**<br>• chemical resistance (easily cleaned)<br>• durable, withstands wear and tear<br>• scratch resistant (maintains aesthetic look)<br>• impact resistant<br>**Polystyrene mudguard/front panel:**<br>• chemical resistance (easy to clean)<br>• flexible.<br>**Any other suitable explanation.** | | |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (b) | | Candidates are expected to name three appropriate manufacturing processes used in the production of the go karts and explain why each one is suitable.<br><br>**Processes could include:**<br><br>**Commercial go-kart:**<br>• extrusion of tubular steel<br>• bending tubular frame<br>• press forming for wheels<br>• piercing to provide holes for assembly<br>• drilling<br>• injection moulding of seat<br>• welding of frame parts<br>• use of jigs in assembly/welding<br>• dip coating of tubular frame<br>• use of standard components (nuts/bolts).<br><br>**Domestic toy go-kart:**<br>• extrusion of tubular mild steel<br>• bending tubular frame<br>• piercing to provide holes for assembly<br>• drilling<br>• injection moulding of seat<br>• welding of frame parts<br>• use of jigs in assembly/welding<br>• rotational moulding for ABS wheels (accept injection moulding)<br>• vacuum forming mudguard, front panel<br>• use of standard components (nuts/bolts). | **6** | **Three** appropriate mass manufacturing processes and their suitability explained.<br><br>Maximum of **3 marks** for naming of processes (**1 mark** each process)<br><br>Maximum of **3 marks** for explanations of suitability.<br><br>**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.<br><br>**NB** Marks can be awarded for correct explanation of an incorrect process.<br><br>*The ABS wheels have been vacuum formed (**0 marks**, incorrect process) as it produces the intricate detail. (**1 mark**, correct justification for injection moulding)*<br><br>*Galvanising (**0 marks, already given in question**) makes the mild steel rust proof. (**1 mark**)*<br><br>*Dip coating (**1 mark**) is appropriate for the mild steel frame as it protects the ferrous metal from rusting (**1 mark**) and adds aesthetic value. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | | | **Explanations could include:**<br>• repeatability of process<br>• accuracy of process<br>• economies of scale (mass/batch)<br>• shape/form is suitable for process<br>• surface finish/no further finishing required<br>• uniform cross section for extrusion<br>• intricate detail<br>• hollow shape produced<br>• Process suitable to material form<br>• thin sheet polystyrene suitable for vacuum forming<br>• sheet mild steel suitable for press forming<br>• strength achieved through welding<br>• easy assembly/maintenance using nuts/bolts<br>• protection (galvanising, painting or plastic coating only)<br>• aesthetic reasons (painting/plastic coating)<br>• chemical resistant (galvanising /painting/plastic coating only)<br>**Any other suitable explanation.** | | |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (c) | | Candidates are expected to describe how the following have influenced the design of the go karts:<br>• function<br>• safety.<br><br>To attract full marks, candidates must reference both function and safety in their answer.<br><br>**Descriptions are likely to include:**<br><br>**Function:**<br>• steering wheel to turn wheels<br>• appropriate gearing allows easy pedalling<br>• air filled tyres provide shock absorption for comfort<br>• grip on wheels/tyres<br>• hole in seat for easier lifting (domestic toy go-kart)<br>• use of standard components allows easy maintenance<br>• mudguards prevent **user** getting wet/dirty<br>• material appropriate for outdoor use, water resistant<br>• adjustable seat position for comfort.<br><br>**Safety:**<br>• stability (span of wheels to prevent rolling)<br>• finger traps minimised (chain guard)<br>• textured seat prevents slipping<br>• lockable break prevents go-kart rolling when stationary (commercial go-kart)<br>• hand operated break for safe stopping<br>• reflectors for safety, improved visibility<br>• tubular steel front bumper protects user<br>• grip texture on pedals prevents slipping<br>• bucket seat (domestic toy go-kart) holds user secure.<br><br>**Any other suitable description.** | **5** | **Five** appropriate descriptions at **1 mark** each.<br><br>**A maximum of 4 marks** can be awarded for any single design factor **(4 + 1).**<br><br>**Ignore headings of function and safety, there will be overlap between the two.**<br><br>*Commercial go kart has a lockable brake to allow the user to safely stop on a hill. (**1 mark safety**)*<br><br>*Domestic go kart has a hand operated brake to allow the user to control their speed. (**1 mark function**)*<br><br>*The go kart wheels have been designed to go over bumpy ground. (**0 marks, wheels are different on both, answer would need to reference commercial**)*<br><br>*Safety has influenced the design of the go kart through there not being any small parts that a child could trap their fingers. (**0 marks, finger traps relate to the chain guard only**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (d) | | The candidate is expected to describe how aesthetics aspects has influenced the design of these go-karts.<br><br>**Aesthetics aspects are likely to be examined in terms of:**<br>• shape<br>• line<br>• form<br>• proportion<br>• pattern<br>• light<br>• texture<br>• colour<br>• fashion<br>• style/brand<br>• contrast<br>• harmony<br>• balance/symmetry<br>• market trends<br>• suitability for target market.<br><br>**Any other suitable description.** | **4** | **Four** appropriate comments at **1 mark** each.<br><br>Candidates must refer to **four different** aesthetics aspects. Responses should be based on the aesthetic facts relating to the go karts.<br><br>*The red body contrasts with the black seat. (**1 mark**)*<br><br>*The textured wheels contrast with the smooth seat. (**1 mark**)*<br><br>*Designer has incorporated lines into the second go kart to make the overall design more eye catching and visually appealing. (**0 marks**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (e) | | Candidates are expected to explain the benefits and drawbacks for the **manufacturer** of using standard components during the production of the go karts.<br><br>**Explanations are likely to include:**<br><br>**Benefits:**<br>• reduced costs (explained)<br>• ensures consistency/less waste/improved Quality Assurance<br>• ease of ordering (readily available)<br>• sourcing reduces lead time – speeds up production process<br>• enables JIT<br>• reduces the number of manufacturing processes<br>• standard sizes simplifies production process<br>• greater flexibility in manufacture (can be used on other products)<br>• simplifies assembly<br>• simplifies the use of a mass production line.<br><br>**Drawbacks:**<br>• delivery issues<br>• cost of outsourcing<br>• reliability of supplier<br>• quality assurance<br>• sustainability issues.<br><br>**Any other suitable explanation.** | **4** | **Four** benefits/drawbacks for the **manufacturer** at **1 mark** each.<br><br>Maximum of **3 marks** for each area **(3+1).**<br><br>*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**)*<br><br>*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**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| **2.** | (a) | | Candidates are expected to identify a suitable material for the carabiner and explain why it is appropriate.<br>**Responses are likely to include:**<br>**Material Selection:**<br>• aluminium<br>• mild steel<br>• tool steel<br>• high carbon steel<br>• stainless steel.<br>**Explanations are likely to include:**<br>• strength, support weight.<br>• corrosion resistant<br>• low cost<br>• resistance to fatigue<br>• scratch resistance.<br>**Any other suitable explanation.** | **3** | Maximum **1 mark** for identification of a suitable material.<br>**Two** valid explanations at **1 mark** each**.**<br>**Do not** accept steel.<br>*Stainless steel (**1 mark**) is suitable as it is scratch resistant so will withstand being rubbed harshly against rocks. (**1 mark**)*<br>*Aluminium (**1 mark**) is suitable for the carabiner due to strength being able to hold the weight of the user. (**1 mark**)* |
| | (b) | | Candidates are expected to explain why drop forging is suitable for the manufacture of products such as the carabiner.<br>**Explanations are likely to include:**<br>• single part<br>• surface detail<br>• increased strength<br>• repeatability<br>• high accuracy<br>• economy of scale.<br>**Any other suitable explanation.** | **2** | **Two** valid explanations at **1 mark** each**.**<br>**Do not** accept generic statements linked to production method**.**<br>**Do not** accept intricate detail, without reference to surface<br>*It allows for detail to be included on the surface of the carabiner. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (c) | | Candidates are expected to explain the benefits of using CAD modelling during the design of the carabiner.<br><br>**Explanations are likely to include:**<br>• stress testing<br>• safety testing/no risk of injury<br>• no waste of material<br>• testing appearance<br>• easy to change<br>• easy to share<br>• reduces lead times<br>• increased accuracy/reduced human error<br>• can be used with CAM.<br><br>**Any other suitable explanation.** | **2** | **Two** valid explanations at **1 mark** each**.**<br><br>*You can run simulation to test the performance of the product.* ***(1 mark)***<br><br>*A variety of colours/materials could be applied to the model to see which looks best and is suitable.* ***(1 mark)***<br><br>*Benefit of using CAD modelling during the design is that it can create an accurate representation of what the product will look like.* ***(0 marks)*** |

| Question | | | Expected response | Max mark | Additional guidance |
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| **3.** | (a) | | Candidates are expected to describe how ergonomics has influenced the design of the car interior.<br><br>**Descriptions are likely to include:**<br><br>**Anthropometrics:**<br>(Ignore incorrect percentile range, if given).<br>• seat adjustability<br>• seat width – shoulder width<br>• seat height – back length<br>• length of leg – distance to pedals<br>• buttons to fingertips<br>• steeling wheel – grip diameter<br>• indicator levers – finger/hand length<br>• steering wheel buttons – thumb length<br>• gear stick – hand width/length.<br><br>**Physiology:**<br>• strength to push pedals/buttons/pull handbrake<br>• assisted steering to lessen strain<br>• range of movement to reach other functions, for example, radio<br>• comfort of seat.<br><br>**Psychology:**<br>• information given on display panels<br>• sound when indicating to turn<br>• sound when seat belt engaged<br>• sound when door locks<br>• symbols, for example, hazard lights, fuel indicator<br>• colours used to identify functions.<br><br>**Any other suitable description.** | **6** | **Six** appropriate descriptions at **1 mark** each.<br><br>Candidates must refer to all 3 areas of ergonomics to attract full marks.<br><br>Award **a maximum of 5 marks** if a candidate refers to only two areas.<br><br>**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.**<br><br>Candidates **must** relate anthropometrics to part of the body. **Do not** accept generic body parts for example hand sizes, without clear description.<br><br>*It is east to identify what each button does so they can be used efficiently while driving. (**0 marks**)*<br><br>*The designer has incorporated visual cues on the radio of well-known symbols to help indicate their use. (**1 mark**)*<br><br>*The car seats will be adjustable to ensure that even people with the smallest arms can still reach the wheel. (**1 mark**)*<br><br>*Ergonomics has influenced the width of the gearstick. This means it will be able to fit the hand of most people. (**0 marks**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (b) | | Candidates are expected to describe the role of **two** other members of a design team.<br><br>**Descriptions are likely to include:**<br><br>**Lawyer:**<br>• responsible for any legal matters such as applying for patents/trademarks<br>• negotiates contracts.<br><br>**Materials technologist:**<br>• provides advice on the selection of suitable materials for manufacture<br>• ensure that any materials selected are suited to the methods of production.<br><br>**Production Engineer:**<br>• provide advice on production planning and tooling for manufacture<br>• work with material technologists to ensure that the product is produced as efficiently as possible.<br><br>**Market Researcher:**<br>• will work with focus groups to find out their needs/wants<br>• helps set prices for the product.<br><br>**Project Managers:**<br>• make sure projects are completed on time<br>• manages staff<br>• manages budgets.<br><br>**Designers:**<br>• provides the initial inspiration and creative input for the product<br>• manages product development.<br><br>**Any other suitable description.** | **4** | **Four** valid descriptions at **1 mark** each**.**<br><br>**2 marks** may be awarded for an extended description.<br><br>**No marks** should be awarded for answers related to ergonomists.<br><br>**No marks** awarded for simply identifying the team member.<br><br>Award **a maximum of 3 marks** if a candidate refers to only one design team member.<br><br>Marks must only be awarded for **two** members.<br><br>*Accountants are responsible for ensuring employees are paid correctly (**1 mark**) and produce cash budgets/income statements. (**1 mark**).* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (c) | | Candidates are expected to explain one benefit and one drawback of using sub-contractors.<br>**Explanations are likely to include:**<br>**Benefits:**<br>• are only hired when needed<br>• may provide fresh ideas<br>• may have specialist skills and knowledge<br>• allows company to focus on other areas.<br>**Drawbacks:**<br>• can be more expensive<br>• reliability<br>• quality assurance<br>• IPR Issues.<br>**Any other suitable explanation.** | **2** | **Two** valid explanations at **1 mark** each**.**<br>*One benefit of using a sub-contractor is that they may bring new knowledge and advice during the development of the product concerned.* ***(1 mark)***<br>*One drawback of using a sub-contractor is that there may be too many opinions on how the product should be manufactured. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| **4.** | (a) | (i) | Candidates are expected to describe how technology push has influenced the design of products.<br><br>**Descriptions are likely to include:**<br>• touch screen technology<br>• enhanced graphics<br>• miniaturisation<br>• wi-fi capability<br>• improving audio technology<br>• improvements in graphics/video technology<br>• increased memory capability<br>• 'cloud' storage<br>• voice recognition<br>• connected products<br>• wireless charging<br>• flexible/curved screens<br>• augmented reality.<br><br>**Any other suitable description.** | **2** | **Two** valid descriptions at **1 mark** each.<br><br>**Do not** award marks for giving a definition of technology push.<br><br>*Facial recognition in mobile phones is an example of technology push. (**0 marks**)*<br><br>*Facial recognition has influenced the design of mobile phones, giving the user the ability to access their phone without touching it. (**1 mark**)* |
| | | (ii) | Candidates are expected to describe how market pull has influenced the design of products.<br><br>**Descriptions are likely to include:**<br>• need for accessibility<br>• affordability<br>• portability<br>• improved quality (of product)<br>• health/fitness tracking<br>• aesthetics – colour/style options<br>• mobile payments<br>• e-tickets (transport etc.)<br>• online features<br>• compatibility with existing products/previous version(s) of products.<br><br>**Any other suitable description.** | **2** | **Two** valid descriptions at **1 mark** each.<br><br>**Do not** award marks for giving a definition of market pull.<br><br>*Mobile phones to be smaller so they are more portable. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (b) | | Candidates are expected to describe **two** appropriate methods of carrying out research into the needs of the target market.<br><br>**Descriptions are likely to include:**<br>• questionnaires/surveys<br>• user trials/trips<br>• focus groups<br>• observations.<br><br>**Any other suitable description.** | **4** | **Four** valid descriptions at **1 mark** each.<br><br>**2 marks** may be awarded for an extended description.<br><br>**No marks** should be awarded for simply naming research methods.<br><br>Marks must only be awarded for **two** methods.<br><br>*Questionnaires/surveys could be used to ask the target market what they want/need from a product (**1 mark**). This could include things such as aesthetic factors, you then record your results and incorporate in your design. (**1 mark**)*<br><br>*Looking at existing products or potential competitors to understand what is successful within the target market and what can be improved. (**1 mark**)*<br><br>*Questionnaires are used to provide market research on what consumers are looking for in a product. (**0 marks**)* |
| | (c) | | Candidates are expected to describe what is meant by planned obsolescence and give an example of how this may have influenced the design of products.<br><br>**Descriptions may include:**<br>• changes in fashion/style<br>• ability to change parts of the product, for example, covers, personalisation<br>• durability of parts, materials and construction<br>• maintenance/replacement issues<br>• compatibility of software/hardware<br>• technology slowing down/lagging.<br><br>**Any other relevant answer.** | **2** | **1 mark** for description of planned obsolescence.<br><br>**1 mark** for an example of how it has influenced the design of a product.<br><br>*Planned obsolescence is when a company deliberately makes their product fail after a certain amount of time. (**1 mark**)*<br><br>*Companies stop updating their software in older devices to encourage users to buy a new one. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| **5.** | (a) | | Candidates are expected to explain why elastomers are suitable for these parts.<br><br>**Explanations are likely to include:**<br>• improving the comfort to the user<br>• enhancing the seal/suction<br>• maintain colour<br>• flexibility/stretch to fit different face shapes.<br><br>**Any other suitable explanation.** | **2** | **Two** valid explanations at **1 mark** each**.**<br><br>**Do not** accept waterproof.<br><br>*Elastomers are appropriate as they create a seal. (**1 mark**)*<br><br>*Not effected by elements such as water, meaning they won't lose their pigment. (**1 mark**)*<br><br>*Available in a variety of colours. (**0 marks**)* |
| | (b) | | Candidates are expected to describe how production and planning systems are used to improve efficiency during the manufacture of products.<br><br>**Descriptions are likely to include:**<br><br>**Production methods:**<br>• one-off production (prototypes)<br>• batch production<br>• mass production<br>• use of jigs/fixtures<br>• use of patterns<br>• use of standard components<br>• CAD/CAM<br>• CNC machining (automation)<br>• rapid prototyping<br>• JIT<br>• sub-contracting<br>• quality control.<br><br>**Planning systems:**<br>• Gantt charts<br>• flow charts or any other sequence planning method. | **4** | **Four** valid descriptions at **1 mark** each.<br><br>**No marks** to be awarded for simply stating a production or planning technique.<br><br>*JIT could be used, this is when you order stock to come in as you need it (**1 mark**), to reduce warehouse storage. (**0 Marks**)*<br><br>*One-way manufacturers can improve efficiency is by using Gantt charts, this allows the manufacturer to know their time schedule and if they are behind or not. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | | | **Descriptions should relate to improvements in efficiency by:**<br>• reducing lead-time<br>• reducing delays in purchasing of components<br>• maximising output/less hours lost in production time<br>• maximising workforce/labour requirements<br>• maximising efficient use of plant machinery<br>• structured planning of production (JIT)<br>• increase in quality assurance and control of production<br>• increase in productivity<br>• reducing stock wastage<br>• reducing manufacturing costs.<br>**Any other suitable description.** | | |
| | (c) | | Candidates are expected to describe the marketing techniques that companies could use to maintain or improve their market share.<br>**Descriptions are likely to include:**<br>• use of targeted advertising (tv, magazines, social media)<br>• celebrity endorsement / influencers<br>• product placement in film and tv<br>• reduced price to improve sales<br>• increase marketing/advertising<br>• available in a range of colours (target market choice).<br>**Any other suitable description.** | **2** | **Two** valid descriptions at **1 mark** each**.**<br>**No marks** should be awarded for simply naming marketing techniques.<br>*Packaging could be changed as this may spark interest in the business. (**1 mark**)*<br>*One marketing technique is celebrity endorsement, if they see their favourite celebrity endorsement, they are more likely to buy it. (**1 mark**)*<br>*Companies could use TV adverts to maintain their market share. (**0 marks**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| **6.** | (a) | | Candidates are expected to describe methods that could be used to identify materials.<br><br>**Descriptions are likely to include:**<br>• flame tests (may include flame colour or fume smell)<br>• comparison to other materials<br>• aesthetic aspects<br>• density/float tests<br>• scratch tests<br>• drop tests<br>• visual examination of surface finishes<br>• magnetism<br>• identification symbols on plastic parts.<br><br>**Any other suitable description.** | **3** | **Three** valid descriptions at **1 mark** each.<br><br>**No marks** for simply stating a method.<br>*Flame tests can be carried out on plastics to see if they melt/char/continually burn, and any smells recorded. (**1 mark**)*<br><br>*Colour and grain can help determine the type of wood. (**1 mark**)*<br><br>*Flame test can be carried out on metals as they burn with a different flame and different smell. (**1 mark**)*<br><br>*Different materials could be identified using symbols or letters somewhere on the material. (**0 marks**)*<br><br>*It could be put in water to see if it floats, this will test the buoyancy. (**0 marks**)* |
| | (b) | | Candidates are expected to outline the factors that would influence the choice of assembly method used.<br><br>**Factors are likely to include:**<br>• transportation of product (assembly at home/flatpack)<br>• material used<br>• permanent/semi-permanent<br>• disassembly<br>• economic factors<br>• target market (choking hazards for children)<br>• volume of product (one off/mass manufacture).<br><br>**Any other suitable response.** | **3** | **Three** valid factors at **1 mark** each.<br><br>*The material used would influence the assembly method used, you can't weld wood. (**1 mark**)*<br><br>*One factor that can influence the choice of assembly method is the volume of product being made, as if there is a small amount or large amount the assembly method will be different. (**1 mark**)* |

| Question | | | Expected response | Max mark | Additional guidance |
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| | (c) | | Candidates are expected to describe **other** ways in which designers and manufacturers can reduce the environmental impact of their products.<br><br>**Descriptions are likely to include:**<br>• making products easy to repair<br>• making products easy to upgrade<br>• easy to identify materials<br>• biodegradable materials<br>• easy to disassemble<br>• circular economy<br>• use of processes that do not cause harm to the environment<br>• manufacture of the product close to the market to minimize transport<br>• electric vehicles for transport<br>• efficient machinery<br>• reduced volume of material used in each product<br>• reduce number of materials used<br>• reduce number of processes used<br>• minimise waste (during production)<br>• reduced or no packaging<br>• buy from sustainable sources<br>• efficient in use ('A' rated products)<br>• use of renewable energy for production<br>• use of durable materials to increase lifespan of product.<br><br>**Any other suitable description.** | **4** | **Four** valid descriptions at **1 mark** each**.**<br><br>**2 marks** may be awarded for an extended description.<br><br>**Do not** award marks for responses relating to the use of recycled or recyclable materials.<br><br>*Using more environmentally friendly materials (**1 mark**)*<br><br>*Reducing the amount of packaging (**1 mark**)*<br><br>*Make products from a material that has been recycled (**0 marks**).* |

| Question | | | Expected response | Max mark | Additional guidance |
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| **7.** | | | This question is set to test the candidate's ability to present a reasoned discussion about a variety of graphics that can be used effectively at different stages in the design process.<br><br>**Descriptions are likely to make reference to some of the aspects below:**<br>• variety of graphics available. (2D/3D sketch, orthographic, oblique, one-point perspective, isometric, two-point perspective, exploded/assembly, sectional, scale drawing, working drawing, rendered — **all can be manual or CAD**).<br><br>**Idea Generation:**<br>Graphics used at this stage are mainly exploratory. Simple, quick sketches outlining the basic idea. No need for too much detail or rendering.<br>• freehand and carried out at a fast pace<br>• range of 2D/3D sketches<br>• oblique<br>• isometric<br>• perspective.<br><br>**Development — Exploration/Refinement:**<br>Graphics used at this stage are initially exploratory and will become progressively more detailed.<br>• designer will still be problem solving, graphics may still be produced quickly<br>• some explanatory graphics may begin to appear to help visualise emerging details<br>• range of 2D/3D sketches<br>• detailed views/part sketches<br>• pictorial drawings<br>• scale drawings<br>• orthographic/dimensioned drawings of emerging details<br>• exploded sketches of emerging details<br>• sectional sketches of emerging details<br>• rendered views (manual/CAD). | **8** | Although there is an underlying body of knowledge required to answer it, there is a very wide range of possible answers. Therefore, the question is marked holistically.<br><br>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.<br><br>The table below should be used to award **appropriate marks.** |

| Question | | | Expected response | Max mark | Additional guidance |
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| | | | **Production/Manufacturing:**<br>Graphics used at this stage are to aid production. These will be rich in information containing sufficient detail to allow prototypes to be made and final manufacture to take place. These graphics require a high degree of accuracy.<br>• orthographic drawings/working drawings — produced on CAD or with drawing equipment<br>• sectioned orthographic<br>• exploded.<br>**Presentation:**<br>Graphics used at this stage are mainly presentation/promotional. These graphics would be used to communicate the design to the client and for advertising/promotional purposes. These must not be too technical as the client may not understand them. Graphics may also be used to gain feedback from focus groups for aesthetic feedback.<br>• must provide a very clear image that is visually appealing<br>• graphics should look as realistic as possible<br>• manual rendered illustration<br>• render CAD illustration.<br>Whilst the response can include these types of graphics, it should be noted that the candidate may include others. | | |

| 0 — 2 marks | 3 — 4 marks | 5 — 6 marks | 7 — 8 marks |
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| An answer which falls into this category may do so for a number of reasons.<br>• **limited** knowledge or understanding of the use of graphics in the design process<br>• there is little or no reference to types of graphics<br>• there is little or no reference to stage of design process where graphics are used<br>• very few points are made<br>• much of the response does not answer the question<br>• the answer is simply too thin. | An answer which falls into this category may do so for a number of reasons.<br>• **adequate** knowledge or understanding of the use of graphics in the design process<br>• the answer will be relevant to the question<br>• reference is made to different types of graphics<br>• there is some attempt to reference stage of design process where graphics are used<br>• although examples are used, points made are unclear. | An answer which falls into this category may do so for a number of reasons.<br>• **secure** knowledge or understanding of the use of graphics in the design process<br>• the answer will be relevant to the question and demonstrate a good level of comprehension<br>• clear reference is made to types of graphics<br>• clear reference to stage of design process where graphics are used<br>• several clear points are made and examples are used to support them. | An answer which falls into this category may do so for a number of reasons.<br>• **extensive** knowledge or understanding of the use of graphics in the design process<br>• the answer will be relevant to the question, demonstrating a high level of comprehension<br>• detailed information is given about different types of graphics and how they are used to support designing<br>• detailed reference to stage of design process where graphics are used and its relevance at each stages<br>• all points made are clear and examples are used to support them. |

**[END OF MARKING INSTRUCTION]**