DESIGN AND TECHNOLOGY

Paper 9705/11
AS Level Written Paper

Key messages

Candidates should develop knowledge and understanding of all twelve topics of the syllabus content. Some candidates answered parts of questions to an excellent standard, such as **Question 2(b)**, but were less confident about other areas, such as **Question 1(b)(l)**.

Candidates should be encouraged to read the questions carefully and to take note of command words and instructions given. In some cases, candidates would have scored higher marks if their responses had focused more closely on the demands of the question.

General comments

Many candidates answered questions well and demonstrated strong understanding of the syllabus. Knowledge and understanding of making processes and materials was a strength for many candidates. Knowledge and understanding of technological areas, such as electronic components was less secure for some candidates.

There was no evidence to suggest that candidates did not have sufficient time to attempt all questions. Sketches were generally of a very good standard, with supporting annotations demonstrating an excellent understanding of the topic. Some longer written responses may have benefitted from the use of a more structured approach, such as the use of numbered points or bullet points.

A wide range of responses were seen to **Questions 6** and **7**. For **Question 6**, the design modification proposals were often very impressive, but the analysis of how the modification would meet the needs of people with a visual impairment was sometimes rather superficial. For **Question 7**, many candidates demonstrated an excellent knowledge of fashion and trends but were less successful in discussing how these impacted on the wider issues in design and technology.

Comments on specific questions

Question 1

(a) (i) Most candidates were able to name a non-ferrous metal that could be used to make the support for the desk tidy. Frequently seen correct answers included aluminium, brass and copper. Candidates who gave an incorrect answer often named a ferrous metal, such as iron.

(ii) Most candidates were able to name a thermoplastic that could be used to make the lamp casing. Common correct answers included acrylic, polypropylene, polystyrene and acronyms such as HIPS, PVC and ABS. A common incorrect answer was a thermosetting polymer, such as melamine formaldehyde.

(iii) Most candidates were able to describe a property of pine that made it suitable for the base of the lamp. Many candidates correctly referred to how easy it would be to cut, shape or join the material, the aesthetic qualities of the material, its sustainability or that it is relatively inexpensive to purchase compared to a hardwood. For the award of both marks, a clear description of the property was required, for example that pine can be given a coat of clear varnish that will enhance the appearance of the grain and provide an attractive finish.

(b) (i) Most candidates were able to name an electronic input component. Common correct answers included a switch, a battery and a thermistor. For the award of both marks, a clear description was required, for example that a single pole single throw (SPST) switch would turn the lamp on and off by making and breaking the circuit. A small number of candidates incorrectly named an output component, such as a bulb, rather than input component.

(ii) Most candidates were able to clearly describe that an LED would emit light but relatively few described how an LED converts electrical energy into light or light energy. Some candidates produced a more technical response, explaining how an LED is a semiconductor that emits light when current flows through it.

Question 2

(a) (i) Most candidates were able identify the given planning drawing as a Gantt chart. Some candidates incorrectly stated that it was a chart or a design process chart.

(ii) Common correct answers were a flowchart, cutting list or materials list. The explanation of why a flowchart would be used by a designer often referred to it clearly showing the stages in the manufacture of a product in the correct order. The explanation of why a materials list or cutting list would be used by a designer often referred to these clearly showing the material, size and number of parts required to make a product. Common incorrect answers were often based upon naming and then explaining a type of drawing that was not a planning drawing, for example an orthographic drawing or an exploded drawing.

(b) Many excellent responses were seen to this question. Common advantages for designers using video conferencing to discuss a design proposal included that travelling time and costs are reduced as participants can join remotely from anywhere in the world, that documents can be shared on screen and collectively edited, that discussions can be recorded so that they can be referred to at a later date, that the chat function allows informal discussions and instant feedback and that it is more environmentally friendly as printed documents are not required. Only a very small number of candidates appeared to have little understanding, or experience of using, video conferencing.

Question 3

(a) Candidates were asked to explain one factor that would have been considered when deciding upon the size of the base of the display stand and one factor that would have been considered when selecting the material for the frame. For the size of the base, most candidates explained that it would need to be large enough to ensure the display stand was stable and would not topple over when in use. Some responses explained that it could not be too large as it would present a trip hazard in a school environment. For the material for the frame, correct answers often explained that a PVC frame would not require a finish that could be expensive to apply, that square section tube would be rigid but lightweight so the display stand could easily be moved around, and that PVC tube comes in a range of colours that would improve the aesthetics of the display stand.

(b) (i) Many excellent responses were seen to this question. Most candidates were able to show a permanent method of joining corner **A** of the display stand. The most frequently seen answer was to cut the square section PVC tube to create a mitre joint that was joined with a suitable adhesive. Commonly named adhesives included solvent cement, super glue and pipe weld. The quality of sketches and notes was usually of a high standard and sufficient to communicate the joining method. A small number of candidates incorrectly showed a temporary joining method, involving the use of screws or magnets, or a method of joining the frame to the base.

(ii) Many very creative responses were seen to this question. Most candidates were able to show a temporary method of attaching the corrugated card poster to the PVC frame. The most common answers included the use of slots, clips, push fittings, magnets, Velcro and plastic screw fasteners. The quality of sketches and notes was usually of a high standard and sufficient to communicate the joining method. A small number of candidates incorrectly showed a permanent method of attaching the corrugated card poster to the PVC frame.

(c) Most candidates were able to describe two safe working practices that should be followed when making the MDF base of the display stand. Common answers included wearing a face mask when cutting the MDF with a power saw to avoid inhaling dust particles or making sure eye protection

was worn and all guards were in place when drilling the MDF to prevent dust particles entering the eyes.

Some candidates only partly answered the question as they named Personal Protective Equipment (PPE), such as goggles, but it was unclear what manufacturing process was being undertaken or why the PPE was being worn. The use of gloves was often suggested, but it was not always appropriate to the task.

(d) Many excellent responses were seen to this question. Most candidates were able to identify a suitable finish for the MDF and gave some reasons for their choice. The justifications were usually well reasoned and based upon accurate knowledge of the material and the proposed finish. The most frequently seen finish was paint, with the justification focusing on its availability in a wide range of colours, being relatively cheap to purchase, easily applied with a brush or roller and able to give an attractive finish that is durable and long lasting. Other finishes that were proposed included varnish and a melamine-faced laminate.

Question 4

(a) Almost all candidates stated that one reason for adding a back to the bookcase was to prevent books from sliding off the back. The second reason stated was usually to do with improving the structural stability of the bookcase, giving additional support to the shelves or making the bookcase stronger so that it was able to withstand a force applied to the top corners. A small number of candidates incorrectly stated that that the addition of the back to the bookcase was for aesthetic reasons.

(b) Most candidates were able to explain one way of reducing the amount of energy used during the manufacture of the bookcase. Some candidates answered this question from the perspective of a one-off production and others from quantity production. Many candidates referred to making the bookcase using hand production techniques rather than machines powered by electricity, purchasing the materials in the correct sizes so that less machining was needed, purchasing materials locally so less energy was used in transportation, the use of low energy lighting or machines in the workshop and making sure the workshop was well insulated so that less energy was used to heat it. A small number of candidates incorrectly referred to using alternative sources of energy, such as solar power, that would not reduce the amount of energy used.

(c) (i) Many excellent responses were seen to this question. Solutions for joining the corner of the bookcase included dowel joints, rebate joints, finger joints, mitre joints, dovetail joints and the use of nails and screws. In weaker responses, the sketches and notes only showed the joint, and not the method of making the joint. Where the method of making the joint was shown, this was usually through a series of steps that included details of tools, equipment and processes to be used. Some candidates did not include details of safety precautions to be undertaken during the making of the joint or only included superficial details of the Personal Protective Equipment (PPE) that would be required, rather than linking the use to a specific stage in the making process.

(ii) Many excellent responses were seen to this question. Methods of making the shelf height adjustable were dowels, pegs, slots and a range of brackets. Some candidates focused on making the shelf adjustable to different heights, for example at 150 mm intervals, and others on making the shelf adjustable to any height. In weaker responses, the sketches and notes only showed the adjustment method and not the method of making it. Where the method of making the adjustment method was included, this was usually shown through a series of steps that included details of tools, equipment and processes to be used. Some candidates did not include details of safety precautions to be undertaken during the making of the height adjustment method or only included superficial details of the Personal Protective Equipment (PPE) that would be required, rather than linking the use to a specific stage in the making process.

Question 5

(a) (i) Candidates were asked to explain why the coffee machine had a digital display. Responses included that the digital display lets the customer know that their drink is being prepared, that the digital display offers real time information on the availability of drinks and their prices, and that the digital display could alert customers to there being a fault with the machine.

(ii) Candidates were asked to explain why the coffee machine uses images of drinks. Responses included that the images on the coffee machine would visually show customers the size and type of drink that they would get, that images are much easier and quicker to understand than written text, and that it would allow customers who cannot read, or understand a particular language, to choose a drink.

(iii) Candidates were asked to explain why the coffee machine has a tray. Responses included that the tray is designed to collect any spillages when a drink is dispensed into a cup and that the tray can then easily be removed for cleaning. Some candidates also explained that the tray has an indentation that indicates where the cup needs to be placed, reducing the chances of spillages.

(b) Candidates were asked to describe two ways in which the coffee machine has been designed with ease of maintenance in mind. Answers included that the parts of the coffee machine are made of materials such as stainless steel and smooth plastic that can easily be wiped clean, that the machine can easily be opened for a mechanic to remove and replace broken parts and that the machine uses standardised components, such as the digital display that are readily available and can be quickly replaced if faulty.

(c) (i) Candidates were asked to explain one advantage of using contactless technology to control the coffee machine. The most frequently seen answer was that it is more hygienic as the customers' hands do not touch the coffee machine. Some candidates also explained that it would save time as the drink could be ordered from a distance and would then be ready for collection when the person arrived at the machine.

(ii) Many excellent responses were seen to this question. Candidates were asked to use a sketch and notes to show one other way in which contactless technology could be used to control a device. Responses included a remote control used to control a television or air conditioning unit, a key fob used to open a garage door or car door and a voice activated control for a music playing device. The quality of sketches and notes were usually of a very high standard and nearly always sufficient to communicate the idea.

(d) (i) Candidates were asked to use sketches and notes to show how ergonomics had been considered in the design of takeaway coffee cup. Many excellent responses were seen to this question, with the quality of sketches and notes usually of a very high standard. The most common responses showed how the diameter of the cup was based upon the size of a hand, that the corrugations on the card sleeve would provide more grip and prevent the coffee burning the user's hand and that the polymer lid had an opening that would fit into the user's mouth and prevent spillages.

(ii) Candidates were asked to use sketches and notes to show how sustainability had been considered in the design of takeaway coffee cup. Many excellent responses were seen to this question, with the quality of sketches and notes usually of a very high standard. The most common responses referred to card and corrugated card which could be recycled after use, the fact that card is biodegradable so it would not need to go into landfill or be incinerated, and that the polymer lid could easily be separated from cup and sleeve for recycling.

Question 6

Candidates were asked to use sketches and notes to show how the design of one other product could be modified to be more inclusive, allowing it to be used by people who have a visual impairment. Modifications included larger text on medicine packaging, larger images on instructions, the use of brighter colours to highlight potential trip hazards, audible warnings on escalators and braille numbers and letters on a variety of products including remote controls and mobile phones. The quality of sketches and notes were usually of a very high standard and nearly always sufficient to communicate the modification. A small number of candidates did not show how the design of another product could be modified for use by people with a visual impairment and simply described the example given in the question.

Many candidates demonstrated a good understanding of the specific needs of a person with a visual impairment, such as being unable to see small details or colour blindness. For many candidates the strength of their response was in showing how they intended to modify a specific product for use by a person with a visual impairment, rather than analysing how the modification that they had proposed would meet the needs of people with a visual impairment.

Question 7

Candidates were asked to discuss how fashion and trends have impacted on the development of products. Many candidates showed an excellent understanding of fashions and trends through the ages by referring to design movements such as Bauhaus, Streamlining, Minimalism, Modernism and Postmodernism, exemplar products, the use of materials and driving forces within global markets. Weaker responses often only referred to the two coffee tables given in the question.

For many candidates the strength of their response was in demonstrating their knowledge of the topic, rather than discussing the impact of fashion and trends on the wider issues in design and technology. Candidates who successfully discussed how fashion and trends have impacted on the wider issues in design and technology usually gave good examples of economic and environmental factors. Social and cultural factors were usually less well discussed. Excellent responses to this question were usually appropriately structured, based on accurate information, contained numerous relevant examples and included a concisely written conclusion. Weaker responses often appeared to be a collection of thoughts, rather than a balanced discussion.

DESIGN AND TECHNOLOGY

Paper 9705/12
AS Level Written Paper

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Candidates were asked to use sketches and notes to show how the design of one other product could be modified to be more inclusive, allowing it to be used by people who have a visual impairment. Modifications included larger text on medicine packaging, larger images on instructions, the use of brighter colours to highlight potential trip hazards, audible warnings on escalators and braille numbers and letters on a variety of products including remote controls and mobile phones. The quality of sketches and notes were usually of a very high standard and nearly always sufficient to communicate the modification. A small number of candidates did not show how the design of another product could be modified for use by people with a visual impairment and simply described the example given in the question.

Many candidates demonstrated a good understanding of the specific needs of a person with a visual impairment, such as being unable to see small details or colour blindness. For many candidates the strength of their response was in showing how they intended to modify a specific product for use by a person with a visual impairment, rather than analysing how the modification that they had proposed would meet the needs of people with a visual impairment.

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DESIGN AND TECHNOLOGY

Paper 9705/13
AS Level Written Paper

There were too few candidates for a meaningful report to be produced.

DESIGN AND TECHNOLOGY

Paper 9705/02

Product Analysis and Improvement Project

Key messages

- Centres should ensure candidates follow the syllabus content and marking grid for this element of the course as this is a product improvement rather than an entire product redesign.
- Candidates are required to choose an existing commercial product that is on the market and, after detailed analysis, identify one way it could be improved.

General comments

Candidates showed a good range of skills in the design and development of their improvement project.

Candidates need only present research material that directly relates to the identified product and area for improvement. When using questionnaires to assess user needs, it is sufficient to document the key findings rather than all of the information obtained.

Candidates should be encouraged to organise their portfolios according to the six distinct project stage headings. This approach allows them to concentrate on the specific requirements of each section and facilitates the assessment of their work.

Centres are reminded that candidates need to include detailed photographic evidence of the final product that candidates have produced.

Comments on specific assessment criteria

Stage 1: Identifying and analysing a product for improvement

Successful candidates provided a comprehensive analysis of an existing single product, which was the foundation for the design improvement. Broader considerations, including economic, environmental, social, and cultural factors related to the selected product, were an important element incorporated as part of this product analysis.

Less successful candidates spent unnecessary time on the analysis of several different products rather than one. Candidates should be reminded that this is a product analysis and improvement project focussing on one element of an existing product and not a complete redesign.

Stage 2: Identifying one area for improvement

Successful candidates were able to show how their chosen product compared to a range of other similar products available on the market to narrow down the focus to a single area for the improvement.

Several candidates were unable to access the marks for this section as they did not use their research to isolate and justify a single area for future development, choosing instead to select multiple areas for a whole product redesign.

Stage 3: Clarifying the design situation or need and generating ideas

Most candidates demonstrated a clear ability to effectively communicate their ideas through sketching, annotation, and in some instances, high-quality physical and computer modelling to develop concepts for their product. They identified and provided justification for their selection of the designs that were to be taken forward to the final development phase in stage 4 of the project.

Centres should ensure that candidates provide an accurate design brief that clearly describes the need they are addressing in their project.

Most candidates successfully presented a comprehensive specification which they consistently referenced during the design development and manufacturing process. It is essential that each component of the specification requirement is both justified and measurable. This ensures accurate comparisons throughout the design and manufacturing phases of the project, ultimately forming the foundation for evaluation when the product has been completed.

Stage 4: Developing the design and planning

Most candidates documented the development and refinement of one of their initial ideas from stage 3 into a proposal suitable for manufacture. Additional modelling and construction testing at this stage was beneficial as it helped to clarify the specifics and approach for manufacture of the prototype.

Candidates should review their developed proposal against the original design brief and specifications to ensure that it meets all the requirements for the proposed improvement outlined in stage 3.

Detailed time and construction plans should be provided that could enable a skilled person to manufacture the product. These plans should include scale drawings, a list of the materials required, and a manufacturing time schedule for the prototype.

Stage 5: Producing a prototype to demonstrate the improvement

Most candidates produced high quality products that demonstrated their skill in shaping and processing materials into a prototype for the intended use. Documenting each production stage was crucial. Most candidates effectively recorded the practical skills used and tracked project progress throughout manufacturing. Comparing the product to the design brief and specification was necessary to meet the requirements for this section of the assessment criteria.

Some centres implemented a teacher sign-off sheet that documented observations of candidates using safe working practices. This was useful evidence for assessing and moderating candidates' work.

Centres are reminded that providing clear and detailed photographic evidence is a requirement of the syllabus. This documentation should accurately record the step-by-step construction process, the range of techniques used at various stages throughout the prototype production and close-ups of the main features.

Stage 6: Testing and evaluating the improvement

Most successful candidates produced a testing and evaluation plan that provided the platform for a comprehensive assessment of their completed prototype. Accurate and transparent comparisons with the specification, along with user and third-party evaluations, enabled candidates to assess the success of their project and identify clear areas for improvement. Photographic evidence of the product in use was helpful at this stage.

Candidates needed to suggest further improvements to their prototype. This could have been in the form of sketched and annotated designs but needed to consider production techniques and the wider issues in design technology.

DESIGN AND TECHNOLOGY

Paper 9705/31
A Level Written Paper

There were too few candidates for a meaningful report to be produced.

DESIGN AND TECHNOLOGY

Paper 9705/32
A Level Written Paper

Key messages

- Candidates should focus on the important stages when describing a manufacturing process such as in **Question 1**. Some candidates spent far too much time describing the preparation of the material to be used and marking out, and not enough on describing the full process.
- Most responses to questions requiring the candidate to 'discuss' were generally well structured and included a range of relevant issues and supporting examples or evidence. Some responses were very brief and either focused on one issue or gave a short list of issues with limited or no supporting detail.

General comments

Most candidates followed the instructions given and attempted all questions.

The quality of annotated sketching to support answers was generally very good. Most sketches were appropriately detailed and successfully communicated with precision and clarity. Some candidates made minimal or no use of annotation to support their answers and consequently did not produce the detail required to access higher marks.

Comments on specific questions

Question 1

(a) Most candidates stated a suitable material for the tile holder and gave two appropriate reasons to justify the choice of material. Some reasons given were very brief and did not adequately justify the choice of material for the tile holder.

(b) Candidates generally made very good use of clear, annotated sketches and notes to present their responses. A good range of appropriate making processes were given. Most candidates specified an appropriate polymer and gave details of a thermoforming process, such a strip heater and a former to bend the tile holder to shape. Some candidates focussed mainly on the marking out and cutting a rectangular shape and did not include sufficient further detail to access the higher mark range. To attain the highest marks, candidates needed to clearly show detailed knowledge and understanding of an appropriate range of tools and equipment and their correct application.

(c) Most candidates made appropriate changes to simplify the design to suit the manufacturing process required to produce 10 000 identical tile holders. Many changed the material to be used, with the majority of candidates selecting either extrusion or injection moulding as the production method. Many responses were fully detailed but some candidates did not include sufficient detail of the die or mould to access the highest mark range.

Question 2

(a) The majority of candidates gave an appropriate benefit of using 3D printing when modelling ideas. The ability to produce accurate models quickly and viewing and modifying where appropriate were the most common responses.

(b) Most candidates described one correct way in which dimensional checks are used when manufacturing products, with most specifying a measuring tool. Some candidates fully described

the use of gauges to check tolerances of parts or components and referenced digital systems to access full marks.

(c) Most candidates demonstrated a clear understanding of the process of press forming, showing the force applied and the former required to form the shape.

Question 3

(a) Most candidates correctly explained what is meant by the term demographics in a business and commercial context. Many clearly understood the term but some candidates did not give sufficient detail of the reference to business and commercial practices to access full marks.

(b) Candidates produced a good range of correct explanations of one disadvantage to a company of using discounting as a product extension strategy. The most common correct responses focused on the risk of weakening a company's reputation and the harm caused by the initial lack of income.

(c) Most candidates gave details of two ways, other than discounting, in which a company can create more demand for a product. Most candidates gave full and detailed explanations of both ways and achieved full marks. However, a significant number of candidates produced very brief and limited explanations. Innovative changes to the product such as adding features and using social media influencers or celebrities to promote the product were the most popular correct responses.

Question 4

(a) Most candidates correctly explained one benefit of a just in time (JIT) manufacturing system. Cost reductions on operations, mainly storage, due to working on an as needed basis was the most common correct response.

(b) There were some excellent answers to this question and candidates presented a detailed discussion of at least two relevant issues. The most common issues referenced were the expense required to set up an automated system, the consequences of job reductions and that the requirement of very highly skilled specialists could be problematic. A significant number of candidates did not access the higher mark ranges as they produced very brief and limited responses, some in the form of a short list of comments with no relevant supporting detail, structure or logic.

(c) Most candidates referenced quality assurance procedures to evaluate the effectiveness of a manufacturing system. Another popular correct response was the utilisation of a bought-in-inspection system.

Question 5

(a) Most candidates correctly described a process that could be used to enhance the property of a metal. Heat treatment processes such as annealing, hardening and tempering were the most common correct responses.

(b) A wide range of correct explanations of one disadvantage to applying a finish were seen. Cost implications, including the need to continue to apply or repair a finish, and issues relating to customer preferences were the most common responses.

(c) Most candidates had a good understanding of standard components and discussed the importance to manufacturers and consumers of using them when manufacturing products in detail. Most candidates presented a thorough discussion focussing on key issues such as the cost benefits of ordering from a specialist supplier rather than extending manufacturing capacity. The value to customers was referenced by most candidates through the ability to easily repair and maintain many products using easily accessible standard components.

Question 6

(a) (i)(ii) Many candidates made very good use of sketches and notes to produce two different ideas for the storage unit for games equipment. Most ideas were functional with a few candidates exploring more innovative possibilities. Most candidates generated two complete, valid ideas with appropriate supporting detail but not all candidates referred to the given design specification in their annotation.

(b) Evaluations of the ideas were mostly clear and reasons for selection were relevant. The majority of candidates achieved high marks for this question.

(c) Some candidates made excellent use of sketches and notes to develop their chosen idea, showing clear details of development and decision making relating to functions, materials, constructions and finishes. Many candidates did not refer to all requirements of the question and some responses were relatively brief and some only outlined the manufacture of the chosen idea.

(d) Most candidates produced a clear drawing of their complete design solution. Many included some important details and key dimensions. Design proposals were generally realistic and included important details about the product. Some candidates seemed to run out of time and produced unclear, partly completed responses with very limited detail.

(e) Some candidates gave four or more appropriately detailed manufacturing specification points for their chosen idea. A number of candidates incorrectly generated a general design specification of their product. Manufacturing specification points needed to contain enough information to enable another person to manufacture the design. This needed to include the materials that would be used to manufacture each part and the finish to be used. Precise dimensions, tolerances and other relevant details of the production process were also required.

(f) Most candidates clearly explained one benefit of designing the storage unit to be assembled by a consumer. The most popular correct responses included cost benefits for the manufacturer relating to there being no requirement to employ assembly staff, reduced storage space requirements and the ease for consumers of taking home a product and feeling ownership of assembling and finishing to their own preferences.

DESIGN AND TECHNOLOGY

Paper 9705/33
A Level Written Paper

There were too few candidates for a meaningful report to be produced.

DESIGN AND TECHNOLOGY

Paper 9705/04

Design, Realisation and Manufacturing Project

Key messages

- Candidates should not choose design proposals that are too large or complex and which therefore cannot be completed in the time recommended for Stage 4: Realising the product.
- Candidates are recommended to spend around 55 guided learning hours on their Component 4 project. Guidance on the recommended time to be spent on each stage is provided in the specification. This is only guidance and there may be variations depending on the chosen project, but candidates should not need to spend significantly more time than this on their project.
- Centres should ensure they are familiar with all information in the specification material available, and specifically the marking criteria. This will help them to ensure candidates' work is fully focused on the requirements for the paper.

General comments

Candidates identified a wide range of real-world contexts of their own choice which was positive. The approach of choosing an area to explore that candidates have an interest in is at the very core of this project, and similarly the choice of materials is purposely open.

Comments on specific assessment criteria

Stage 1: Identifying a situation or need to produce a design brief and design specification

Candidates were able to identify an area to focus their design project on and generally researched it well. Some candidates completed many pages of research, often near 30 pages in stage 1 of their project which did not ultimately benefit their learning journey. Primary research is particularly valuable in this stage but an over-reliance on secondary research can be counterproductive.

Candidates chose one design situation or need to take forward, providing a justification for their choice. In stronger projects, each point of the design specification was fully justified, with references to the research.

Candidates are recommended to spend around **6 guided learning hours** on Stage 1.

Stage 2: Generating and appraising design ideas leading to a design proposal

Candidates should generate at least three ideas to meet the design brief and design specification. The ideas needed to be supported with annotated sketches and research to feed into the design ideas. Generally, this stage was well attempted by all candidates with some outstanding examples of innovative idea generation and proposals for new products. Candidates had the confidence to explore new ideas that did not simply replicate products that already exist and then iterate them several times as they worked toward an imaginative outcome.

Candidates are recommended to spend around **9 guided learning hours** on Stage 2.

Stage 3: Developing the product and planning for making

Candidates generally documented their development journey clearly with a wide range of different approaches from sketch models and physical models, through to some very impressive CAD and, on occasion, CAM modelling. All of these should be documented with good quality photographs/screenshots and annotations.

Working drawings often communicated all individual parts, as well as assembly details, materials and chosen finishes. Plans to make the final solution were not always included and candidates should be encouraged to produce these.

Candidates are recommended to spend around **9 guided learning hours** on Stage 3.

Stage 4: Realising the product

Candidates need to demonstrate proficiency in a wide range of practical skills. However, some candidates did not communicate their making journey with either clearly annotated or high-resolution photographs. For credit to be awarded, there must be evidence within a portfolio of this aspect. Safe working practices should also be evident.

It is expected that candidates produce a full-sized product/prototype, not a scale model.

Candidates are recommended to spend around **14 guided learning hours** on Stage 4.

Stage 5: Testing and evaluating the product

Stronger candidates carried out appropriate tests on the full-sized prototype showing it in use in its intended environment and by the user. This allowed the candidate to draw meaningful conclusions leading to proposals for further development.

Candidates are recommended to spend around **9 guided learning hours** on Stage 5.

Stage 6: Planning for manufacturing a product in quantity

Stage 6 should be undertaken as a distinct section after the product has been tested and evaluated. This stage should include analysis of at least three wider issues including cultural, economic, environmental and social factors. A plan for manufacturing the final product in quantity should also be evident. However, a small number of candidates did not include this stage in their portfolio.

Candidates are recommended to spend around **8 guided learning hours** on Stage 6.